PREDICTING THE OUTCOME OF OPTICAL INTERNAL URETHROTOMY FOR SHORT SEGMENT BULBAR STRICTURE'

Dissertation submitted to

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UROLOGY

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CERTIFICATE

This is to certify that the dissertation titled ' PREDICTING THE OUTCOME OF OPTICAL INTERNAL URETHROTOMY FOR SHORT SEGMENT BULBAR STRICTURE ' is a bonafide work done by Dr.V.C.Karthik of Government Stanley Medical College, in partial fulfillment of the university rules and regulations for the award of MCh Branch IV Urology degree under my guidance and supervision during the academic year 2011 – 2014.

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DECLARATION

I, Dr. V.C. Karthik, solemnly declare that the dissertation titled " PREDICTING THE OUTCOME OF OPTICAL INTERNAL URETHROTOMY FOR SHORT SEGMENT BULBAR STRICTURE" is a bonafide work done by me at the Government Stanley Medical College and Hospital during September 2012 to March 2014 under the guidance and supervision of Prof Dr. V. Selvaraj MS MCh (uro), Professor and HOD, Department of Urology, Stanley Medical College and Prof Dr. P. Govindarajan, Professor of Urology, Stanley Medical College, Chennai.

This dissertation is submitted to the Tamil Nadu Dr. MGR Medical University, towards partial fulfillment of requirement for the award of M.Ch. Degree (Branch – IV) in Urology three years course.

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INTRODUCTION

Urethral stricture is a relatively common urological disorder which every urologist encounters in his regular urological practice. They pose a significant problem from both clinical and economic point of view. It is a very ancient disease. It has even been described by Sushruta [1], the ancient Indian surgeon, as 'mutra marga sankocha'; it was treated with dilatation with a stick lubricated with ghee.

The incidence of urethral stricture can only be estimated at best. In the west, the incidence is around 0.6 % [2]. The incidence is probably higher in india.

The etiology of stricture urethra has changed over times. Trauma has taken over infection as the commonest cause. The trauma can be either external (trauma) or internal (instrumentation). Another important cause is Balanitis Xerotica Obliterans also known as lichen sclerosus. In a small group of patients, no particular cause can be made out and they are grouped under 'idiopathic'.

The management of stricture has also evolved over the times. From lubricated reed in the times of Sushruta the treatment has increased in complexity to the present day urethroplasties. Despite the availability of various options for the treatment of stricture urethra, internal urethrotomy has remained as a popular

option among the urologists in view of its simplicity, safety and shorter learning curve.

Despite its popularity, the success rates of internal urethrotomy is not very encouraging compared to urethroplasty. The reported success rates of internal urethrotomy varies from 60% to 90%. Various factors responsible for recurrence have been investigated like age of the patient, length of the stricture, site of the stricture, amount of the peri-urethral scarring, diameter of the stricture etc. Among these various factors, the diameter of the stricture or in other words the percentage of narrowing at the point of the maximum stricture on a Retrograde Urethrogram is the least studied.

AIMS AND OBJECTIVES

1) To evaluate patients with urethral stricture disease at our institution.

2) To predict the outcome of Optical Internal Urethrotomy for short segment bulbar strictures by measuring the percentage of lumen narrowing at the stricture site on the Retrograde Urethrogram.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

EPIDEMIOLOGY OF URETHRAL STRICTURE DISEASE

DEMOGRAPHICS

In the west, stricture urethra is more prevalent in the aged population. The incidence increases as the age increases. The disease is more often treated at tertiary centres rather than primary or secondary centres. In contrast, in third world countries, the disease is, by and large, due to infectious, inflammatory or traumatic causes and tends to affect younger population.

INCIDENCE

It is difficult to measure the incidence of stricture urethra. In the west, the incidence rate is more (0.6%) and in excess of 5000 inpatient visits per year have been recorded. But, of late, the incidence has come down in the west owing to the increasing use of anastamotic and substitution urethroplasty procedures. But in India, male stricture urethral disease remains to be common; trauma and inflammation being the important causes. Most often the disease is treated by conservative or minimally invasive techniques like dilatation or internal urethrotomy and hence the recurrence rates are high.

PRESENTATION

The patients usually complain of obstructive Lower UrinaryTract Symptoms like weak stream, straining, hesitancy, intermittency, post-void dribbling, increased frequency, dysuria. Symptoms may be worsened by formation of secondary vesical calculi. They mimic symptoms of prostatomegaly in aged people. In young males they may cause anejaculation and therefore infertility. Epididymitis is another manifestation of an undiagnosed stricture. Another devastating sequelae of untreated, undiagnosed stricture disease is Fourniers Gangrene. Induration may be felt along the urethra on palpation.

PATHOLOGY

The normal urethra is lined by pseudostratified columnar epithelium. Deeper to this epithelium lies a layer of connective tissue rich in blood supply and smooth muscle. The connective tissue harbours rich amount of fibroblasts bathed in a matrix of collagen, proteoglycans, elastic fibres. And this connective tissue layer is the site of main pathology in stricture urethra. Spongiofibrosis of the connective tissue is the hallmark of urethral stricture disease.

ETIOLOGY

The most common cause for stricture today in developed and developing countries is trauma. The trauma may be external trauma (Road Traffic Accident with pelvic fracture or straddle injury) or internal trauma (instrumentation). Another meta-analysis has shown that the causes of stricture are iatrogenic, idiopathic, trauma and inflammation in decreasing order of frequency [3].

The etiology of stricture is different in different regions of the world. This difference is probably due to disparity in the quality of health care, access to expert centres, innate regional variations and so on. These etiological differences may lead to differences in the symptomatology and management of strictures in different parts of the world.

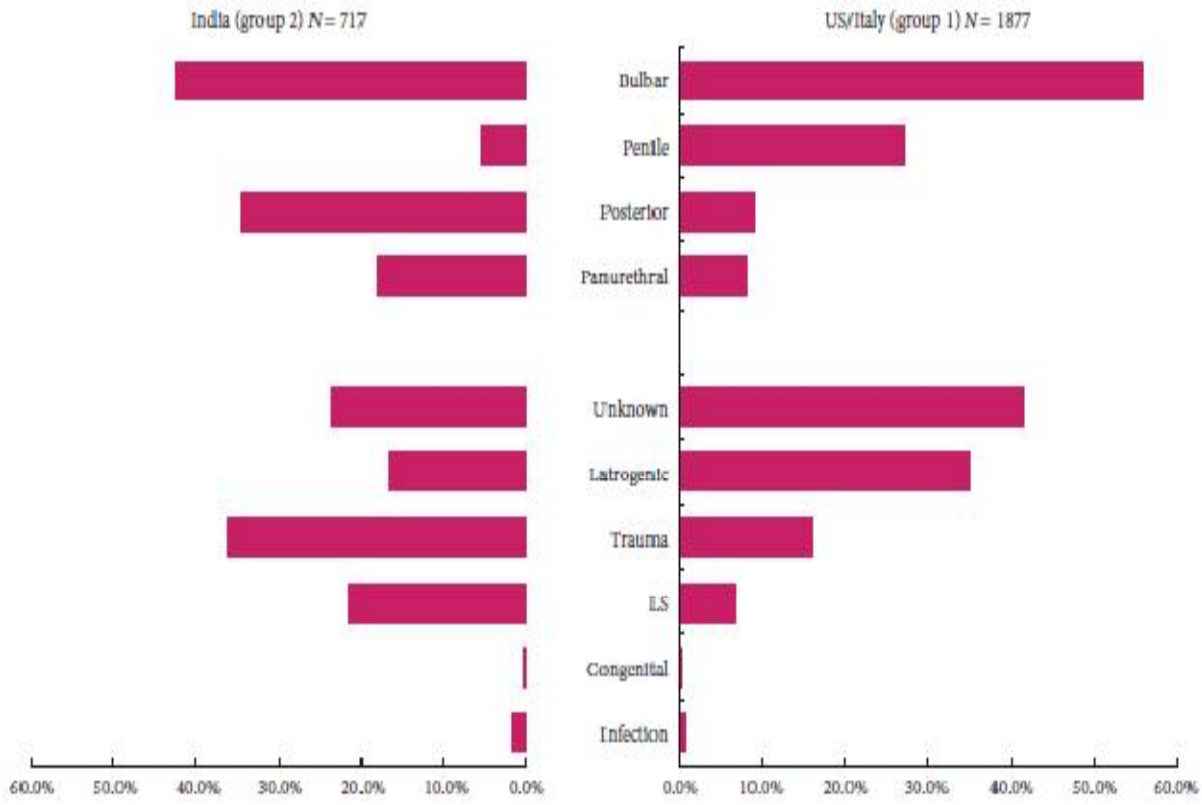
There have been very few studies addressing the incidence and etiology of stricture in our country. In 2013, kulkarni et al [4] conducted a retrospective study comparing the demographics and etiology of stricture urethra in our country and the west. This study was done across three centres – one centre in India, one centre in the USA and another in Italy. Due to similarity in demographics, data from Italy and the USA were combined into one group (group 1) and those from India were formed into another group (group 2).

As many as 2589 patients were totally studied in this study. Group 1 had 1877 patients and group 2 had 717 patients. The salient outcomes of this study were that Iatrogenic strictures (failed hypospadias repair, catheter induced, instrumentation, radiotherapy and TURP) were more common in the west than in India (35 % vs 17%); the so called Idiopathic strictures were also more prevalent in the west compared to India (41% vs 24%). On the contrary, Traumatic strictures were more common in India compared to the west (36% vs 16%). Also strictures due to Lichen Sclerosus were also more common in India (22% vs 7%).

	US/Italy (group 1), *N* = 1877		India (group 2), *N* = 717		*P* < 0.05
		95% CI	*n* (%)	95% CI	
Aetiology, *n* (%)					
Unknown	776 (41.3)	39.2–43.7	169 (23.6)	20.5–26.8	Y
Iatrogenic	657 (35.0)	32.7–37.1	119 (16.6)	13.8–19.2	Y
Failed hypospadias repair	319 (17.0)	15.3–18.9	19 (2.6)	1.5–3.8	Y
Catheter	185 (9.9)	8.5–11.2	41 (5.7)	4.2–7.5	Y
Instrumentation	117 (6.2)	5.2–7.4	25 (3.5)	2.2–4.9	Y
Radiotherapy	11 (0.6)	0.3–0.9	1 (0.1)		
TURP	25 (1.3)	0.8–1.9	33 (4.6)	3.1–6.1	Y
Trauma	296 (15.8)	14.1–17.4	259 (36.1)	32.6–39.6	Y
LS	129 (6.9)	5.8–8.0	150 (21.0)	18.3–24.0	Y
Infection	15 (0.8)	0.4–1.2	13 (1.8)	0.8–2.8	N
Congenital	4 (0.2)	0.1–0.4	3 (0.4)	0–1.0	N
Location					
Bulbar	1046 (55.7)	53.5–57.9	303 (42.3)	38.6–46.0	Y
Penile	506 (27.0)	24.9–28.9	38 (5.3)	3.8–7.1	Y
Posterior	170 (9.1)	7.7–10.4	247 (34.4)	30.8–38.1	Y
Panurethral	155 (8.3)	7.0–9.5	129 (18.0)	15.2–20.8	Y
Mean age, years	42.7	41.9–43.4	38.2	36.9–39.4	Y

The site of stricture was also compared in this study. The findings were – **bulbar strictures**: west – 56% , India – 42%; **penile strictures**: west – 27% , India – 5%; **posterior urethral distraction defects**: west - 9% , India – 34%; **pan**

urethral strictures: west – 8% , India – 18%. As we can see, though bulbar urethral strictures were the commonest strictures in both the groups, the incidence of penile strictures was more common in the west while posterior urethral distraction defects and pan urethral strictures were more common in India.

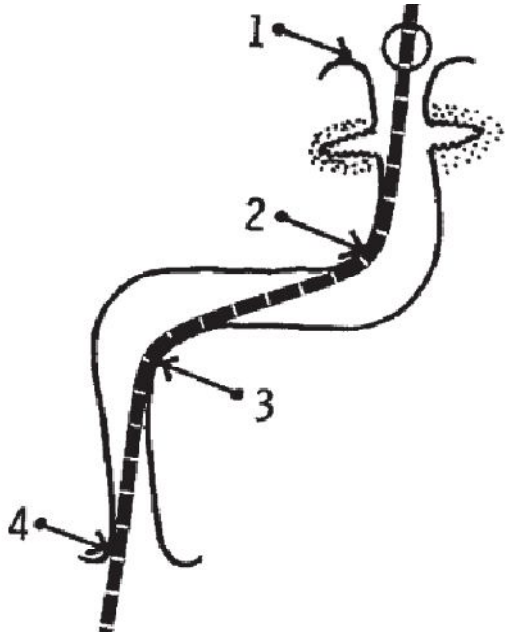


Gonococcal strictures are no longer common. The most common cause of inflammatory stricture appears to be Lichen Sclerosus Atrophicus (LSA). Lichen Sclerosus Atrophicus is a chronic inflammatory disease of idiopathic etiology which begins in the glans, meatus and prepuce. Clinically it appears as a whitish plaque often causing a phimosis. It can also involve perimeatal area and in course

of time, the fossa navicularis and distal anterior urethra also get involved probably due to high pressure voiding. A pan-urethral stricture may also ensue secondary to the high pressure voiding due to Lichen Sclerosus Atrophicus.

Strictures found in the fossa navicularis are usually secondary to either inflammatory or instrumentation. The procedures incriminated in the causation of stricture are Trans-Urethral Resection of Prostate, prolonged catheterization, cystoscopy, prior hypospadias surgery in decreasing order of frequency. Radical prostatectomy causes stricture in a small percentage of patients.

Strictures secondary to instrumentation occur due to ischemia at the site of greatest pressure. These pressure points are usually found at fossa-meatus, bulbo-membranous junction and peno-scrotal junction.



The above picture shows the sites of the ischemic strictures following instrumentation.

1. Bladder neck
2. Bulbo-membranous junction
3. Peno-scrotal junction
4. Fossa-meatus

Prolonged catheterization is another important cause for stricture. The pathophysiology may be traumatic insertion, the catheter material may elicit an inflammatory response from the urethra or may be due to ischemia of the surrounding urethra due to placement of a large-calibre catheter.

EVALUATION OF PATIENTS

As in any other disease management, the success of the management of stricture urethra depends upon proper choice of patient and selection of the most suitable surgical procedure for that particular patient. A thorough history and examination of a stricture patient is important.

PATIENT HISTORY

History taking should be thorough and meticulous. The voiding and storage symptoms are asked for. History of hematuria, dysuria or any episodes of acute

retention are documented. These patients often suffer from urinary tract infections in the form cystitis, prostatitis or epididymitis. Hence history relevant to these should be sought for. Though less common nowadays, history of contact exposure should be asked for.

History of any previous trauma to the penis or perineum should be asked for. History of any difficult catheterization which is also a form of trauma should also be asked for. The patient may also have undergone a previous hypospadias repair which should be enquired. Another important history is history of treatment of pelvic fracture which may play an important role in patient positioning during stricture surgery as some orthopaedic procedures may preclude lithotomy positioning.

Any past history of dilatations or previous internal urethrotomy should be asked for. Interval between the previous urethrotomy and the present onset of symptoms may give a clue to the nature and density of the stricture.

Another important and sensitive history is that of sexual function. Patient is asked for his erectile and ejaculatory functional status and carefully documented.

Any other medical illnesses like diabetes mellitus are carefully recorded as it may have an impact on the treatment.

Social history is also important. Smoking has been found in some studies to adversely affect the results of urethroplasty. Tobacco chewing may damage the buccal mucosa thus precluding a buccal mucosal graft.

PHYSICAL EXAMINATION

GENERAL

The body habitus and in particular the pelvic girdle is thoroughly examined for any stigmata that may preclude a prolonged lithotomy positoning. The oral mucosa as mentioned earlier is examined for any evidence of scarring or other epithelial changes that may preclude harvesting of a buccal mucosal graft.

ABDOMEN

Sometimes a palpable bladder may be present representing a chronic retention. One important thing to look for is the site of the SPC. Since the SPC tract may have to be used during the stricture surgery it should be properly located in the midline. An off-midline suprapubic cystostomy tract may sometimes necessitate a open cystotomy at the time of surgery to facilitate passage of sounds.

GENITALIA

The status of foreskin should be examined as in some cases the foreskin may be used as a flap or graft for reconstruction. The meatus is examined for adequacy. Presence of any evidence of lichen sclerosus is noted as it may determine the selection of tissue for reconstruction.

Some patients may be harbouring urethrocutaneous fistulae due to a failed previous repair. Palpation of urethra is done to look for any induration. The degree of induration corresponds to the severity of the spongiofibrosis. Sometimes a hard induration may suggest the presence of an urethral carcinoma. Digital rectal examination in an older male may indicate the presence of an enlarged prostate which may offset the findings of a uroflowmetry.

LABORATORY EVALUATION

Urinary tract infection has to be ruled out in any patient with urethral stricture. All the patients should undergo a proper urine analysis and urine culture and proper antibiotics should be administered before surgery. A few longstanding patients with stricture may have also developed a medical renal disease. Hence Renal Function Tests should always be done prior to any intervention.

IMAGING OF THE URETHRA

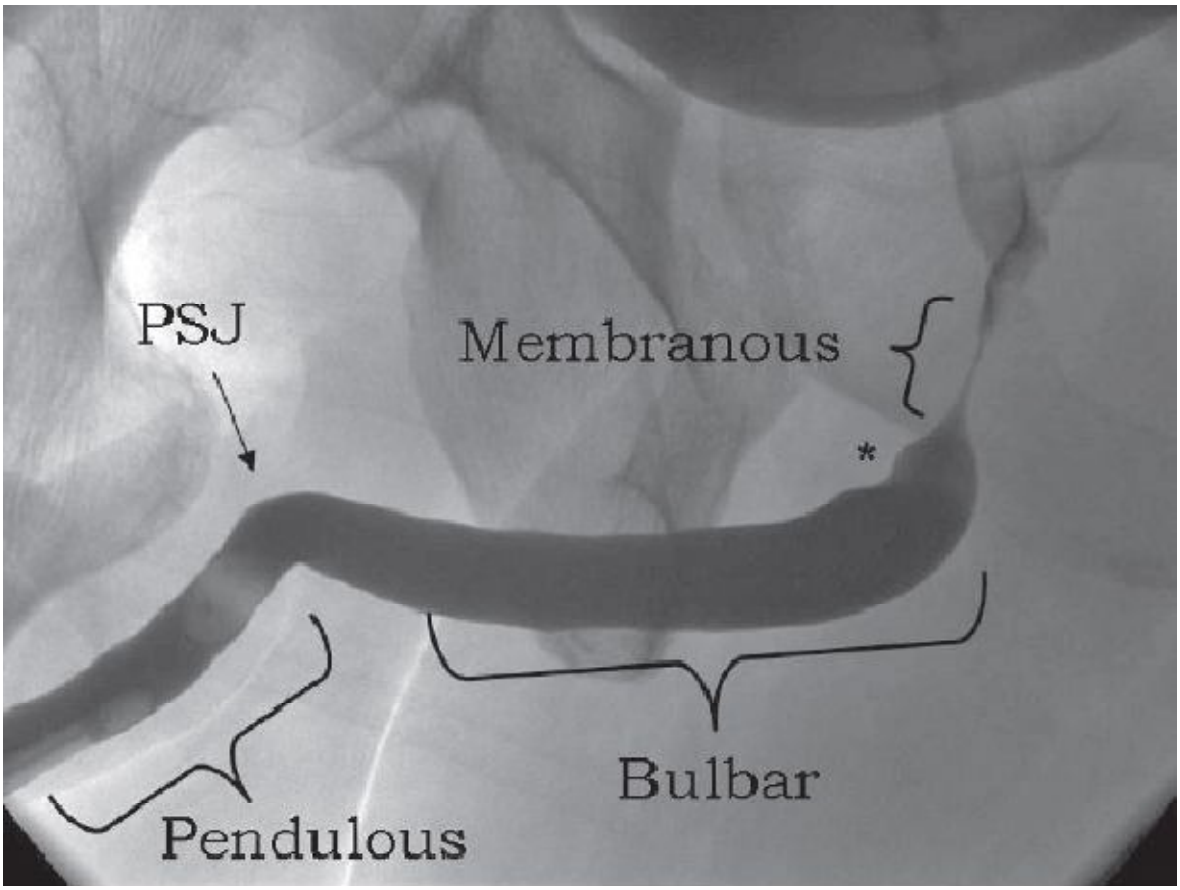
Of the numerous imaging modalities available to image the urethra, the most commonly used modalities are retrograde urethrography (RGU) also called as ascending urethrography and the voiding cystourethrography (VCUG). Other modalities which are slowly gaining ground are the Sonourethrography, Magnetic Resonance Imaging (MRI) and Computerised Tomography (CT).

By imaging, one aims to determine the presence of stricture, its number, site, length and depth. Usually Retrograde Urethrogram (RGU) and Voiding Cysto-urethrogram (VCUG) suffice to garner the above information but sonourethrogram and Magnetic Resonance Imaging (MRI) may be used in special situations especially when the degree and depth of the spongiofibrosis have to be assessed.

Before going into the imaging of the urethra it may be appropriate to review the anatomy of the male urethra.

The urethra is traditionally divided into four segments namely, the prostatic urethra, the membranous urethra, the bulbar urethra and the penile or the pendulous urethra. The prostatic and the membranous urethra are grouped as the posterior urethra while the bulbar and the penile urethra are grouped as the anterior urethra.

The penile urethra lies within the penis and is the longest segment of the urethra. The distal penile urethra consists of a focally dilated area near the meatus called the fossa navicularis.



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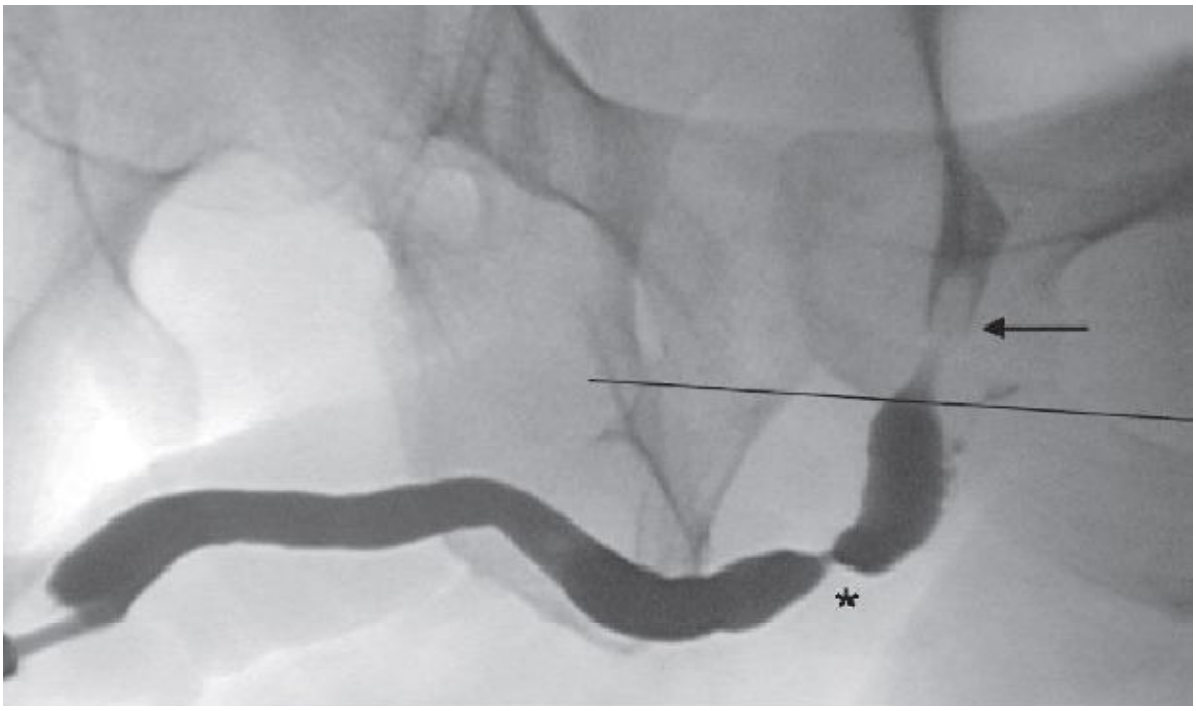
The bulbar urethra lies proximal to the penile urethra and is separated from it at the peno-scrotal junction. The bulbar urethra happens to be the most distensible part of the urethra. The bulbar urethra as it transitions into the membranous urethra assumes a conical shape at the bulbomembranous junction. This ‘coning’ of the

bulbo-membranous junction is an important landmark on the retrograde urethrogram.

The membranous urethra is the least distensible segment of the urethra as it courses its way through the urogenital diaphragm.

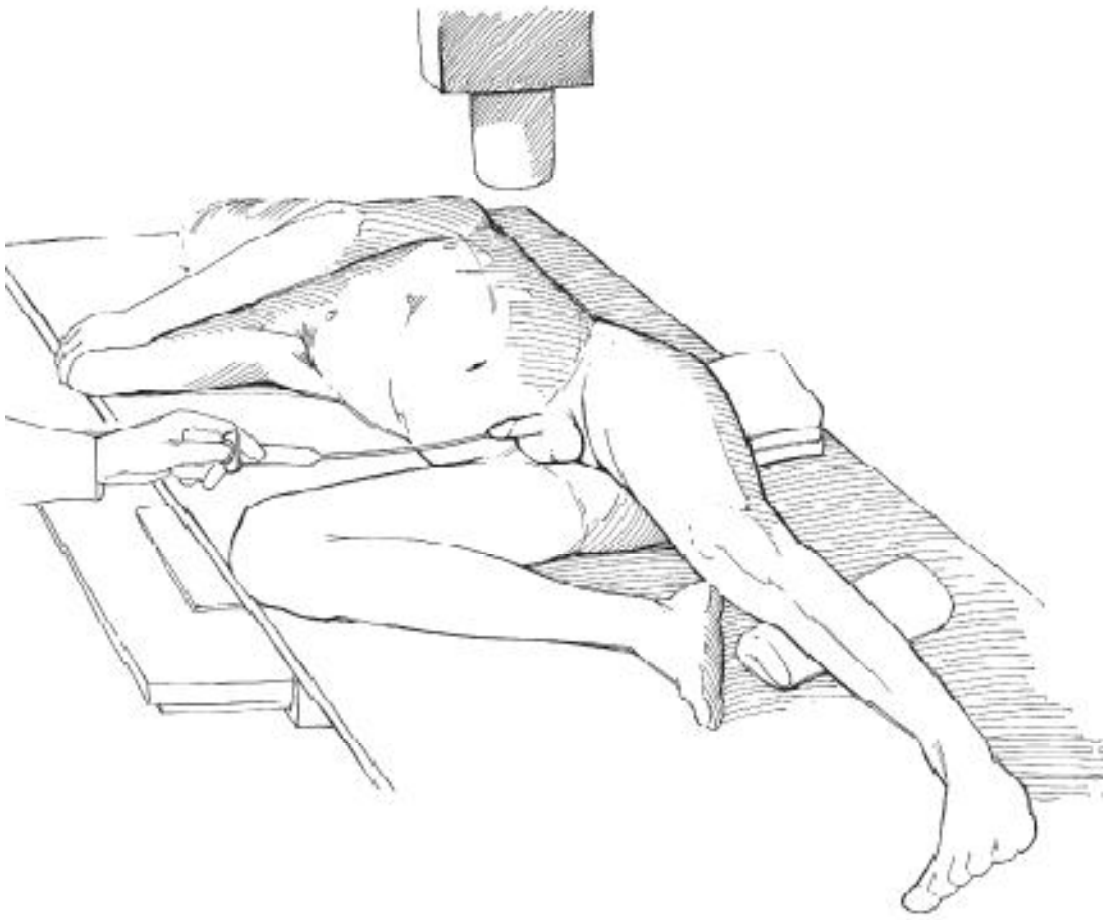
The prostatic part of the urethra lies proximal to the membranous urethra. A small hillock of tissue on the posterior aspect of the luminal surface of the prostatic urethra, often visualized as a filling defect on the retrograde urethrogram, is the verumontanum.

On a urethrogram, the junction between the membranous and the prostatic urethra can be identified using a useful landmark. An imaginary line made across the inferior border of the obturator foramina intersects the bulbo-membranous junction.



RETROGRADE URETHROGRAPHY

Retrograde Urethrogram (RGU) is the most basic investigation for the urethra. For this test, the patient is made to lie in a semi-supine position with a 45 degree tilt and the lower thigh and knee are flexed. This position is important to get a proper image and it also overcomes the fore-shortening which may occur otherwise.



The glans penis is properly cleansed and then a small feeding tube or a small foley catheter is gently placed into the fossa navicularis and the balloon inflated with 1-1.5 ml of water. After this, the contrast agent amounting to around 20 ml is gently introduced into the urethra taking efforts and measures to eliminate air bubbles. And the radiographer is asked to take the image.

VOIDING CYSTOURETHROGRAPHY

It can be combined with retrograde urethrography when it is called as ‘opposing urethrogram’ or ‘up and down –o-gram’ which is useful to assess posterior urethral distraction defects. VCUG is used to assess the posterior urethra. In normal voiding, there is opening of the bladder neck and distension of the prostatic urethra.

The procedure involves filling of the bladder with contrast instilled through a urethral Foleys catheter or through a supra-pubic catheter. Once the bladder is filled, the urethral Foleys catheter is removed. The position of the patient is the same as that of the retrograde urethrography. The patient is requested to void into a container. The patient may be asked to void in a standing position. Radiographs are taken when the patient is voiding. Additional films are taken after the bladder is emptied.

SONOURETHROGRAPHY

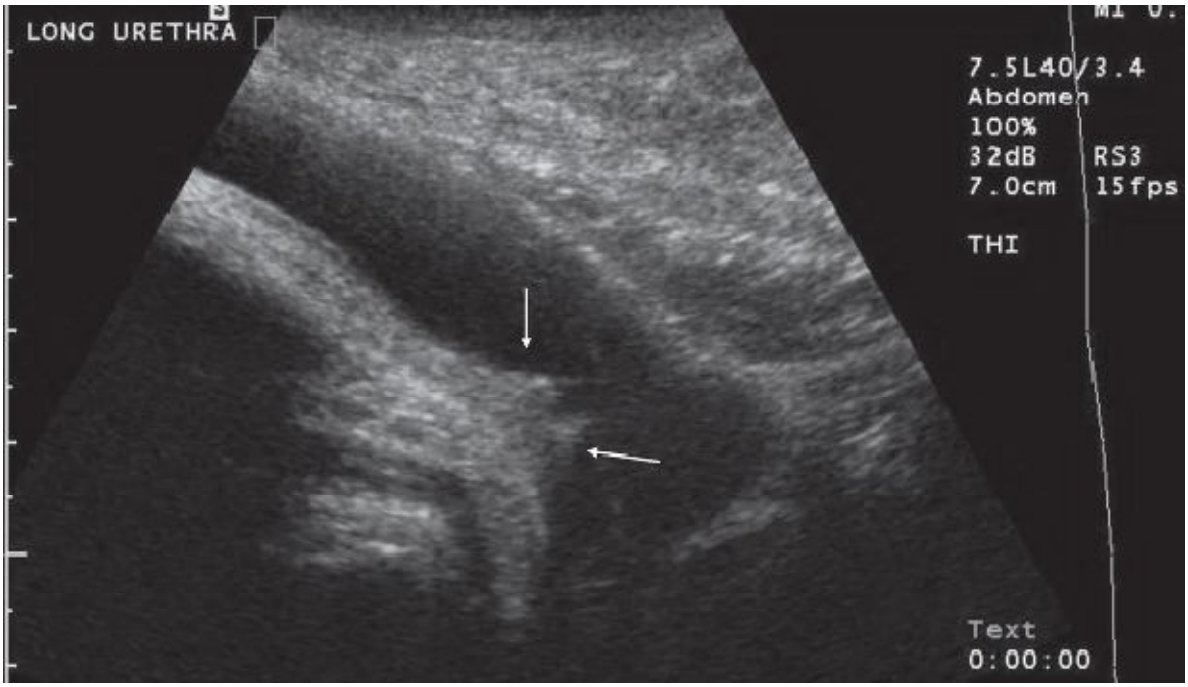
It is not used for routine imaging for urethra. It is useful when one wants to determine the degree of spongiofibrosis around a stricturous segment. It is particularly useful for characterization of the bulbar urethra. To do this test, first the urethra is instilled with sterile saline through a Foleys catheter. The penis is made to lie on the abdomen and with the help of a high frequency (7.5 MHz) linear

transducer which is placed on the ventral aspect of the penis the urethra is insonated. To insonate the bulbar urethra the probe is placed onto the perineum.

The sonourethrography is a more precise tool to assess the stricture length as there is no foreshortening of length as in a retrograde urethrogram; this attribute of sonourethrogram gains more prominence when dealing with the bulbar urethra as foreshortening with retrograde urethrogram is more common in this segment.

Another important use of sonourethrography is in determining the degree of spongiofibrosis which a retrograde urethrogram cannot throw light upon. As we will see, the degree of spongiofibrosis is directly proportional to the chances of recurrence following internal urethrotomy. On the sonourethrogram, areas of

spongiofibrosis appear as areas of hyperechogenicity; normal corpus spongiosum is hypoechoic.



The above picture shows a mound of tissue along the dorsal aspect of the bulbar urethra (arrows) causing a mild stricture.

The downside of sonourethrography is its limited availability, lack of expertise in handling the procedure and the cost.

MAGNETIC RESONANCE IMAGING (MRI)

MRI is rarely used in the evaluation of stricture urethra. It is used in very specific situations in centres where it is available. It may be especially useful in

assessing posterior urethral trauma and as with sonourethrography it may be useful in determining the spongiofibrosis.

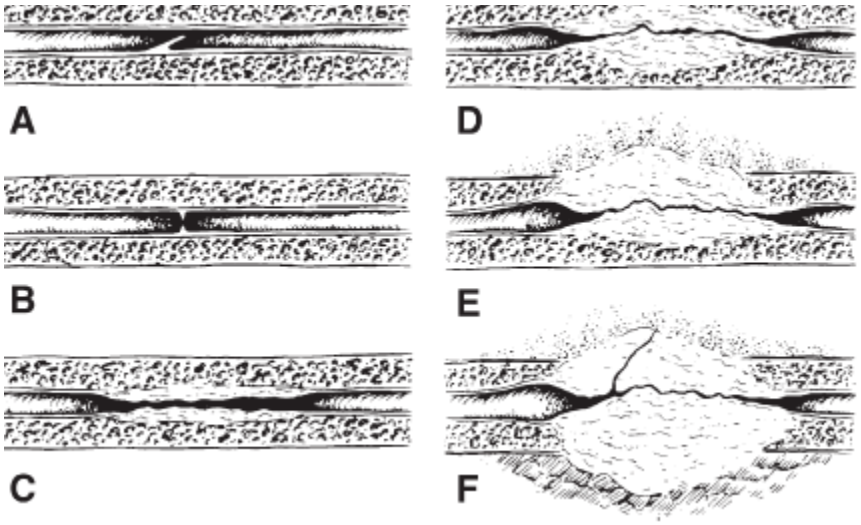
Both T1 and T2 weighted images are used and if necessary gadolinium based contrast can be used. To view the posterior urethra, coronal or axial images may be taken and to view the anterior urethra sagittal views are ideal. For more accurate viewing dilute gadolinium contrast may be instilled into the urethra after which the penis is clamped with a special clamp which does not hamper the performance of the MRI and then fat saturated T1 weighted images are taken.

Inspite of the above factors, MRI is not a widely used imaging employed for stricture urethra. The reason for this is the high cost of the procedure and non – availability of equipment at all the centres.

CLASSIFICATION OF STRICTURE URETHRA

Stricture urethra results from scarring of the epithelium lining the urethra which can encroach into the deeper spongiosal layer. What we call as the stricture is constituted of collagen fibres and fibroblasts. It can circumferentially contract thereby abbreviating the urethral length which results in constriction of the urethral lumen. It has been found over the course of urological practice that the patients suffering from stricture disease become symptomatic only the lumen size exceeds 16 fr.

Several classification systems have been proposed by various people over the years. The one proposed by Devine et al [5], classified strictures based on the degree of the spongiofibrosis. They classified strictures from A to F with A type stricture having no spongiofibrosis and F type stricture having spongiofibrosis affecting the entire corpus spongiosum with potential fistula formation.



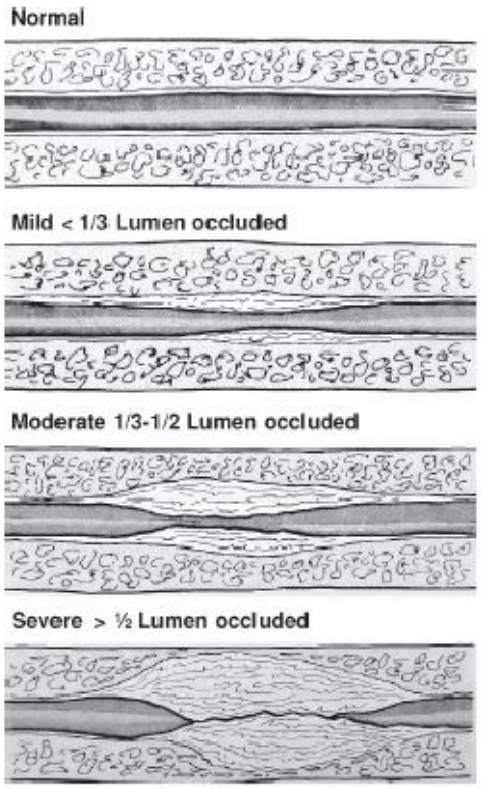
The above diagram shows the Devine Classification of stricture urethra

But the practical difficulty in adopting the above classification is that the degree of spongiofibrosis cannot be reliably and consistently determined by routine non-invasive means. One of the proven methods to determine spongiofibrosis is sono-urethrogram but it may not be available in all the institutions where stricture surgery is practiced. Moreover, it is subjective and depends on the experience of sonologist. Presence of urethral induration on palpation and elasticity of the urethral lumen at the time of urethroscopy have been proposed as markers for the underlying fibrosis. But again these parameters are not always foolproof.

Another classification system for stricture was proposed by McAninch [6] in the year 1988 which is based on the configuration of the urethral lumen as seen on the sono-urethrogram. Accordingly, strictures were classified from mild to severe;

mild type having less than one third of lumen occlusion while the severe type having more than half of the lumen occluded.

Barbagli, an Italian urologist, recommended a staging system for strictures caused by LSA when it affects the penile urethra [7]. According to his system, stage 1 involves the prepuce, stage 2 involves in addition to the prepuce, the meatus and the corona, stage 3 involves, in addition to the above, the fossa navicularis and the anterior urethra. Stage 4 is associated with a precancerous or a cancerous lesion.



McAninch Classification of Stricture Urethra

COMPLICATIONS OF STRICTURES

Stricture disease if left undiagnosed and untreated may result in deleterious complications like UTI, vesical calculi, formation of urethral diverticulum, urethro-cutaneous fistulae. When numerous urethro-cutaneous fistulae occur in the perineum it is known by the eponym 'watering can perineum". Extravasation due to stricture or dilatation of stricture can be disastrous and if infected may result in fourniers gangrene. Another lethal complication of a long-standing stricture is urethral cancer.

ECONOMIC IMPACT

As mentioned earlier, urethral stricture disease is prevalent in third world countries like India. The number becomes swollen when one considers the fact that compared to west most of the stricture cases here are managed conservatively or with minimally invasive procedures like dilatation or internal urethrotomy and hence the recurrence rates are high. These facts when translated into economic impact, urethral stricture disease really becomes an important disease from economy point of view. A study from Rourke and Jordan [8] has shown that urethroplasty is economically cheaper than internal urethrotomy unless the recurrence rate with internal urethrotomy becomes less than 60%.

Another study by Wright et al.[9] has shown that the most cost effective approach may be one session of internal urethrotomy followed by urethroplasty if stricture recurs.

In a country like India, where most of the strictures are still treated by internal urethrotomy with high recurrence rates, economic burden is still higher considering the fact that each session of internal urethrotomy entails a period of admission in the hospital with loss of man-years.

These above facts re-emphasise the need for proper selection of procedure for each patient of stricture urethra.

MINIMALLY INVASIVE PROCEDURES FOR STRICTURE URETHRA

Urethral dilatation and Optical Internal Urethrotomy (OIU) are the two most commonly performed minimally invasive procedures for stricture urethra worldwide. They may be used for the initial treatment of stricture disease with equal effect. The efficacy of Optical Internal Urethrotomy (OIU) is different in different studies, ranging from 60% to 90% with efficacy dropping with longer follow-up.

DILATATION

Dilatation as a treatment for stricture urethra is as old as the disease itself. It has been mentioned even by Sushruta where a reed lubricated with ghee was used as the method of dilatation. With better understanding of the anatomy of the urethra, the instrumentation for dilatation has also improved over the ages.

Dilatation may be effected by a variety of instruments viz., sounds, bougies, filiforms and followers, amplatz dilators or balloon dilators. Whatever the instrument, the aim of dilatation is to stretch the scar tissue without rupturing it [10]. If it ruptures, the resulting injury will heal with more fibrosis and may actually worsen the stricture.

The safest way to effect a dilatation is to serially dilate the stricturous area with increasing caliber of the dilator. The dilators usually used in dilatation clinics are metal dilators with a curved tip. Too thin a dilator may produce a false passage;

hence it is wiser to start with a medium-size dilator. It may be enough to dilate upto 24fr.

Balloon dilators are a recent introduction; they may be less traumatizing, but the down-side being the requirement of fluoroscopy [11].

OPTICAL INTERNAL URETHROTOMY

Optical Internal Urethrotomy (OIU) is best suited for single, bulbar strictures shorter than 2 cm, with minimal spongiofibrosis and with no past internal urethrotomy. Optical Internal Urethrotomy (OIU) may be contra-indicated in suspected urethral malignancy, coagulation disorders or active infection. Optical Internal Urethrotomy (OIU) is not suited for long strictures (>2 cm), multiple strictures, previous Optical Internal Urethrotomy (OIU), strictures other than bulbar where the recurrence rate may be high and unacceptable.

Optical Internal Urethrotomy (OIU), as mentioned previously, is favoured by many urologists because of its simplicity, shorter learning curve, less complications. Hence it may be the case where the procedure is being used indiscriminately by urologists across the world especially in less developed countries.

The present day technique of Optical Internal Urethrotomy was introduced by Hans Sachse of Germany. He designed the cold knife what we use today and it has stood the test of time to this day.

The technique of Optical Internal Urethrotomy is not very difficult to master. The urethrotome with the sachse knife mounted over a 0 or 30 degree telescope is introduced into the urethra; it is important to keep the knife withdrawn. As soon as the stricture site is seen, a guide wire or ureteric catheter is passed through the narrowing upto the bladder. Then with the cold knife incisions are made over the stricturous area till the normal appearing normal caliber urethra is seen.

The incision is usually made at the 12 o' clock position because it is felt that the risk of bleeding is less as there is less chance of injuring the corpora cavernosa at that location [12.] Some urologists have advised multiple radial incisions at 6,9 or 12 o' clock positions citing better results. But recent studies have repudiated this and shown that the results are not much different [13].

Colour Doppler ultrasound may be employed to evaluate the spongiofibrosis around the stricturous areas and also the location of the urethral arteries so that the site of urethrotomy incision can be chosen without injuring the urethral arteries[14].

The catheter may be kept for a variable period following OIU. Contrary to popular belief that retaining the catheter for a longer period will cause moulding of the urethral lumen around the catheter resulting in a better result, it has been found that leaving the Foleys for more than three days actually produces less favourable results. A period of three days of catheterization following OIU has been shown to give better results. Most urologists follow a period of around 4 days of catheterization following OIU.

OTHER METHODS OF URETHROTOMY

OTIS URETHROTOMY – it is a blind technique. A special instrument called as OTIS URETHROTOME which can be opened to a maximum diameter of 45 fr is introduced in a closed position with a knifed mounted on it. The instrument is

introduced upto the peno scrotal junction and is opened upto its maximum size of 45 fr and the knife is withdrawn. This produces a clean, linear cut in the urethra at the 12 o' clock position. Recently it has been advocated to open the urethrotome upto 35 fr only. Otis urethrotomy has been regularly used by many urologists just before Trans-Urethral Resection of Prostate to prevent stricture.

Otis Urethrotome

LASER URETHROTOMY – laser energy sources used are Nd-Yag, holmium, KTP, argon. Circumferential cutting of the stricture is done. Despite initial optimism, results have not been superior to conventional cold knife optical internal urethrotomy.

COMPLICATIONS

DILATATION – false passage, bleeding , extravasation are the some of the important complications encountered when dilatation is done forcibly by an inexperienced urologist. Post procedure infection is another complication which can occur.

OPTICAL INTERNAL URETHROTOMY (OIU) – as mentioned previously, Optical Internal Urethrotomy is a relatively safe procedure. Complication rate of < 10% has been reported [15]. Peri-operative infection has been reported to be as high as 38% in one series [16]. Some of the other complications are fever, extravasation, bleeding, chordee. Erectile Dysfunction is a rare but potentially disastrous complication which can occur. It may be due to direct cutting of the cavernous nerves at 3 and 9 o' clock positions. It can also occur by extravasation followed by fibrosis around the area of the cavernous nerves. Rarely a shunt between the corpora cavernosa and spongiosum may be created giving rise to Erectile Dysfunction [17]. Acute renal shutdown can also occur due to extravasation followed by infection. Hence it is always better to use normal saline as the irrigant.

RESULTS – despite intial optimism, the enthusiasm for Optical Internal Urethrotomy has subdued due to its varied and unpredictable success rate. Various series have shown various results with as low as 35% upto 90%. The recurrence rate increases as the patients are followed up longer. After 5 years, the success rate is only 25% [18]. Strictures can recur even after many years following Optical Internal Urethrotomy. Hence a minimum follow-up for 10 years is recommended [19].

LONG-TERM OUTCOME AFTER OPTICAL INTERNAL URETHROTOMY

The long term results of Optical Internal Urethrotomy are not very flattering. According to a study by Albers [20] in Germany, a total number of 937 patients were managed with Optical Internal urethrotomy at two centres across Germany. The average follow-up was 54 months and 38 months in each centre. The recurrence rate at the first centre with a follow-up of 54 months was found to be 26.9% while the recurrence rate at the second centre with a follow-up of 38 months was found to be 44.6%. a further analysis of the patients at the two centres revealed that the first centre had a more number of idiopathic strictures while the second centre had a more number of iatrogenic strictures. Hence the natural conclusion by the authors was that idiopathic strictures had a more successful outcome after Optical Internal Urethrotomy.

According to another study by pansodoro [21], a total number of 224 patients with stricture urethra were enrolled; patients had strictures from various causes. All the patients were managed by Optical Internal Urethrotomy. The patients were followed up for a period of 98 months; the recurrence rate was found to be 68%. On further analysis, it was found that bulbar strictures had a recurrence rate of 54%, penile strictures had a recurrence rate of 84% while bulbo-penile strictures

had a recurrence rate of 89%. Bulbar strictures with first time strictures, strictures which were less than 1 cm and strictures with a diameter of more than 15 fr were found to have a more favourable outcome. Another important information obtained from this study is that strictures recurred even after 8 years after Optical Internal Urethrotomy. This strongly emphasizes the necessity of long term follow-up of patients after Optical Internal Urethrotomy.

Another study by Santucci [2], a total number of 76 patients who had undergone Optical Internal Urethrotomy were followed. It was found that only around 8% of patients were recurrence free after a period of 5 years.

RISK FACTORS FOR RECURRENCE

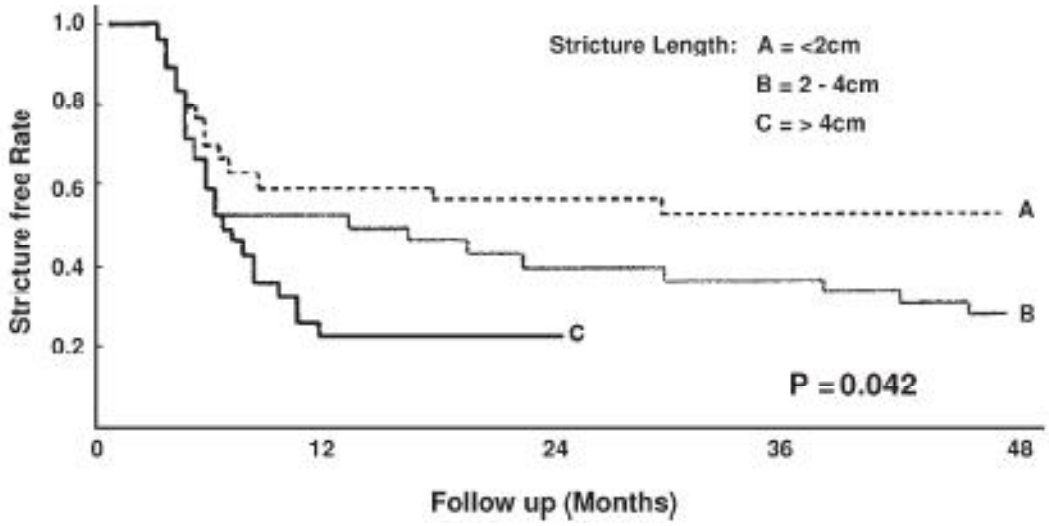
Factors like age of the patient, chronicity of symptoms and etiology of stricture have been shown to have no bearing on the results of Optical Internal Urethrotomy. On the other hand, the important factors which may influence the outcome of Optical Internal Urethrotomy are the following.

PREVIOUS OPTICAL INTERNAL URETHROTOMY – most series have shown that the recurrence rate is high with history of one or multiple sessions of Optical

Internal Urethrotomy. In one series, recurrence rate was 25% for primary Optical Internal Urethrotomy and 55% for secondary Optical Internal Urethrotomy [19].

SPONGIOFIBROSIS – it has been indubitably established that the degree of spongiofibrosis around the stricture area determines the efficacy of Optical Internal Urethrotomy [22]. Strictures with dense spongiofibrosis around the stricture area do not do well with Optical Internal Urethrotomy and require urethroplasty.

LENGTH OF STRICTURE – several studies have shown that strictures measuring greater than 2-4 cm do not do well with Optical Internal Urethrotomy and recurrence rate is high [23].



SITE OF STRICTURE – it has been shown by several series that bulbar strictures respond more favourably to Optical Internal Urethrotomy than penile strictures because of their better vascularity [24].

NUMBER OF STRICTURES – various studies have gone to show that single strictures fare better than multiple strictures with Optical Internal Urethrotomy [25].

PERI-OPERATIVE INFECTION – untreated peri-operative infection has been shown to increase the rate of recurrence in many studies [26].

CALIBRE OF STRICTURE – a single study has shown that Optical Internal Urethrotomy gives better results for strictures measuring more than 15 fr [21]. Another study has shown that percentage narrowing at the maximum area of stricture as seen on the ascending urethrogram can be used to predict the outcome of Optical Internal Urethrotomy [27].

PREVENTION OF RECURRENCE

CLEAN INTERMITTENT SELF-CATHETERISATION (CISC) – following Optical Internal Urethrotomy, the patients are advised to self dilate with a 14 fr tieman catheter. The time-table for CISC is twice weekly for one month, then once weekly, or once daily for one week and then the interval may be increased to once weekly or once in a month. In a study by harris et al [28], patients on CISC for more than 12 months had a recurrence rate of only 14% compared to 40% for patients who had CISC for only 6 months.

But the downside is that CISC should be continued life-long and once it is stopped the recurrence rate becomes similar to control group. Other disadvantages are the occurrence of urethral bleeding and discomfort or refusal to self dilate in some patients.

CLINIC DILATATION – studies have shown the efficacy of clinic dilatations beginning two weeks after Optical Internal Urethrotomy. Recurrences have been found to be less with patients on dilatation compared to no dilatation. Another study has shown no difference in result when CISC was compared with clinic dilatation [29].

STEROIDS – intra-urethral steroid jelly or intraurethral injection of triamcinolone at the time of Optical Internal Urethrotomy have also shown to reduce the reccurence rate in a few studies.

A few other agents like halofuginone, botulinum toxin and mitomycin C have been used following Optical Internal Urethrotomy either as injection into the scar tissue or intra-urethral irrigation in a few experimental studies but are yet to enter mainstream urological practice. Endo urethral brachytherapy using iridum after Optical Internal Urethrotomy has been tried [30] in an experimental study with good results.

FOLLOW-UP

There is no fixed policy on the follow-up time-table. But since the incidence of recurrence is particularly high within the first 12 months, it has been suggested to follow-up the patient after internal urethrotomy or any other urethral stricture surgery on a 3-monthly basis for the first 24 months and then on a annual basis. For Optical Internal Urethrotomy, length of follow-up has been suggested for a minimum of 10 years as recurrence has been observed even after several years.

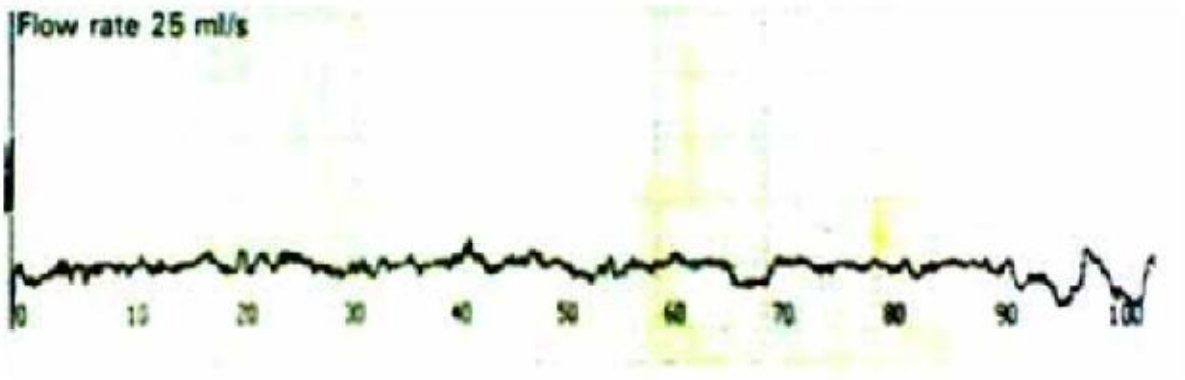
The patients may be followed up by both non-invasive and invasive means.

NON-INVASIVE EVALUATIONS

URINARY FLOW RATE – it is recorded by a uroflowmetry equipment. The peak flow rate approximately gives an idea of any bladder outflow obstruction. The normal shape of the curve is that of a bell-shape whereas that of a patient with stricture is a flat box shaped curve.

Various cut-offs for peak flow values have been suggested to define stricture. But most of the studies give a cut off of Q-max > 15 ml/s with no clinical symptoms as a sign of no recurrence.

A typical uroflowmetry picture of a stricture patient looks like the graph shown below, a ‘plateau’ shaped graph with little difference between the maximum flow and the average flow.



A combination of uroflowmetry with determination of post-void residual urine gives a good idea of the well-being of the patients voiding status.

AUA SYMPTOM SCORE AND URINARY FLOW RATE – one study has used the combination of AUA-SSI greater than 15 and a Q-max less than 15 ml/s to predict recurrence.

INVASIVE EVALUATIONS

URETHRAL CALIBRATION – it is more accurate than urethrography to detect stenoses/strictures.

CYSTOSCOPY – the need for cystoscopy in the follow-up for Optical Internal Urethrotomy is controversial. Stricture is defined as inability to pass a 16 fr scope across the lumen.

URETHROGRAPHY – the regular use of retrograde urethrography during the follow-up of patients after internal urethrotomy may not be feasible due to logistic constraints. It may be indicated when there is a definite clue of a recurrence through non-invasive means or when a re-operation is being contemplated.

MATERIALS AND METHODS

STUDY DESIGN: prospective study

DURATION: September 2012 to March 2014

SETTING: Govt. Stanley Medical College and Hospital Campus

INCLUSION CRITERIA:

Patients with primary bulbar stricture

EXCLUSION CRITERIA:

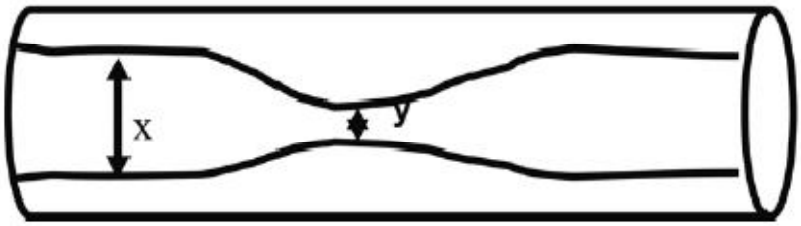
1. Patients with a history of prior intervention
2. Complete block of urethral lumen
3. Stricture greater than 2 cm

METHODOLOGY:

A total number of 51 patients were studied in the above specified period. All patients with primary bulbar urethral stricture were selected. Of those patients, the ones who had any prior intervention in the form of dilatation, Optical Internal Urethrotomy or urethroplasty were excluded. All the patients underwent a standardaised preoperative evaluation including basic urine and blood chemistries, uroflowmetry and a good quality Retrograde Urogram.

On the retrograde urethrogram film, the site of the maximal narrowing was measured. The diameter of the normal lumen distal to the stricture site was also taken. The distal urethral lumen was taken as normal as this part is maximally distended while performing a urethrogram rather than the urethral proximal to the stricture. The percentage narrowing was calculated.

Percentage Narrowing = [(x-y/x) 100]%



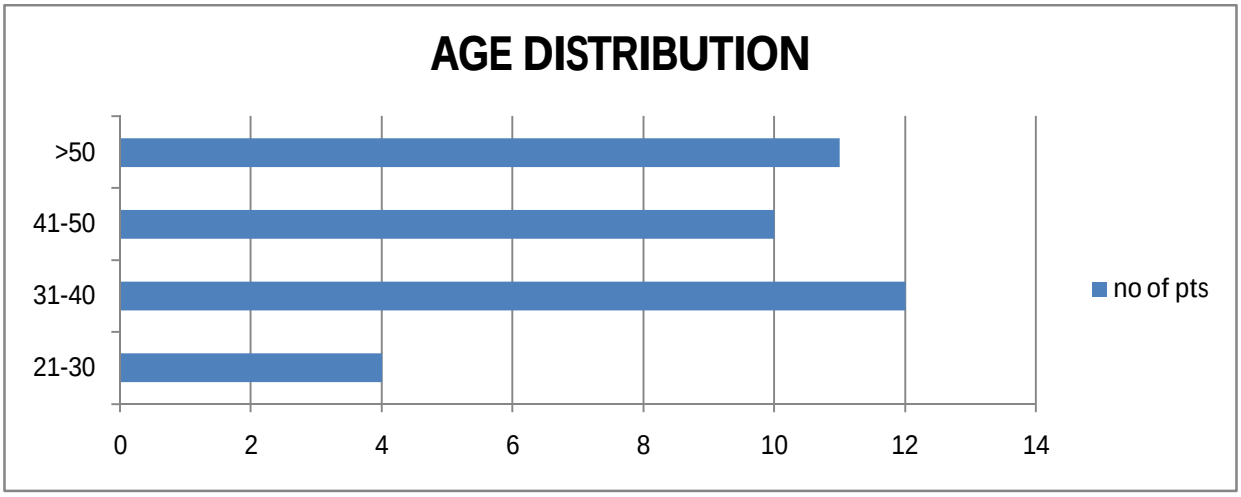
The patients were then subjected to Optical Internal Urethrotomy. Optical Internal Urethrotomy was done using a standard 20 fr sachse urethrotome. Following surgery the patients were advised to self-dilate with 14 fr tieman catheter starting from the 3rd day of removal of Foleys. Foleys was removed on the 7th post-op day. The patients were advised to self dilate for once daily for the first month and then once in 3 days later. Uroflowmetry was done at 3rd and 6th months. Symptom recurrence, inability to pass the tiemans catheter and the necessity for repeat Optical Internal Urethrotomy were taken as treatment failures.

RESULTS

AGE DISTRIBUTION

Age in years	Number of patients	Percentage
21 – 30	4	11%
31 – 40	12	32%
41 – 50	10	27%
>50	11	30%

In our study of 37 patients, majority of the patients, ie., 32% of them were in the age group of 31 – 40 years;30% more than 50 years; 27 % in 41 – 50 years and 4 patients in the age group 21 – 30 years.

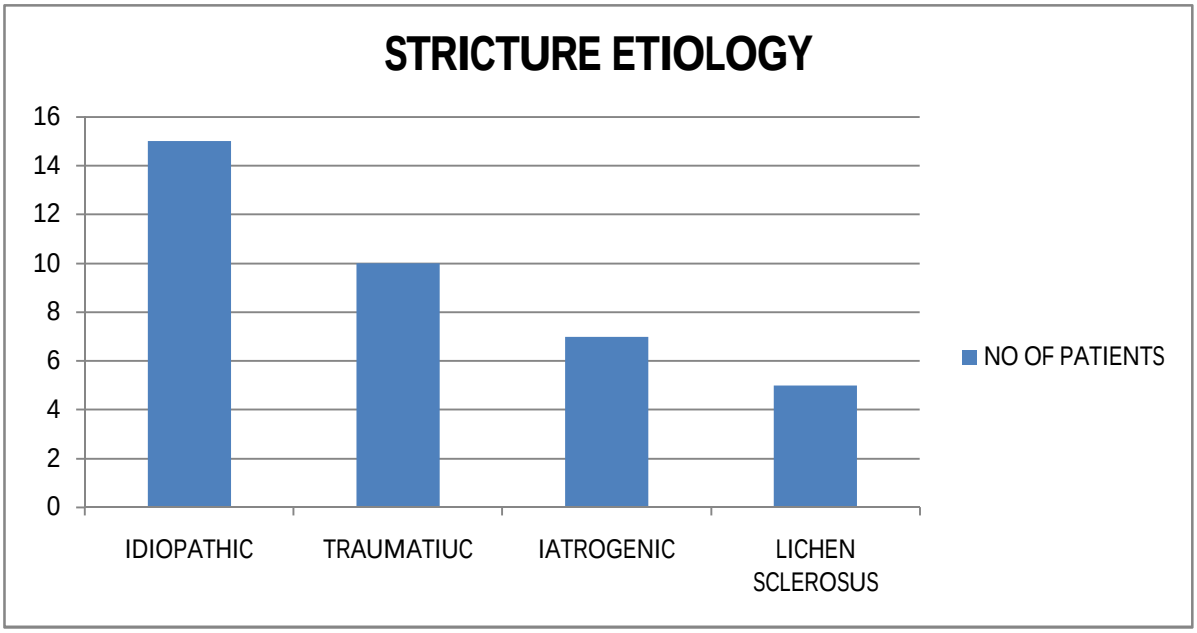


BAR DIAGRAM SHOWING THE AGE DISTRIBUTION

ETIOLOGY

Etiology	Number of patients	Percentage
Idiopathic	15	41%
Traumatic	10	27%
Iatrogenic	7	19%
Lichen sclerosus	5	13%

In our study, the most common etiology was found to be idiopathic (41%) followed by traumatic (10%), iatrogenic (19%) and finally lichen sclerosus (13%). Iatrogenic causes include traumatic catheterization or instrumentation.

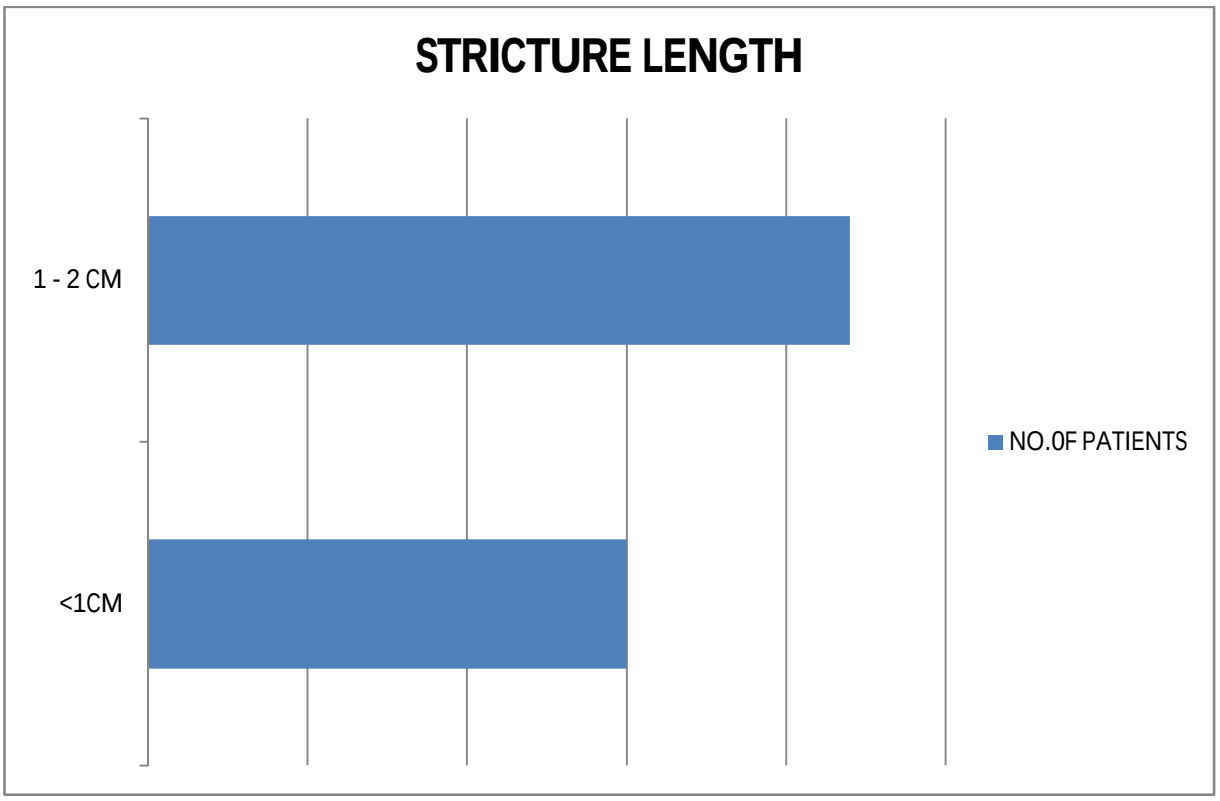


BAR DIAGRAM SHOWING STRICTURE ETIOLOGY

STRICTURE LENGTH

Stricture length	Number of patients	Percentage
< 1cm	15	41 %
1 – 2 cm	22	59%

In our study, 15 patients (41 %) had a stricture length below 1 cm and 22 patients (59 %) had a stricture length between 1 and 2 cm.

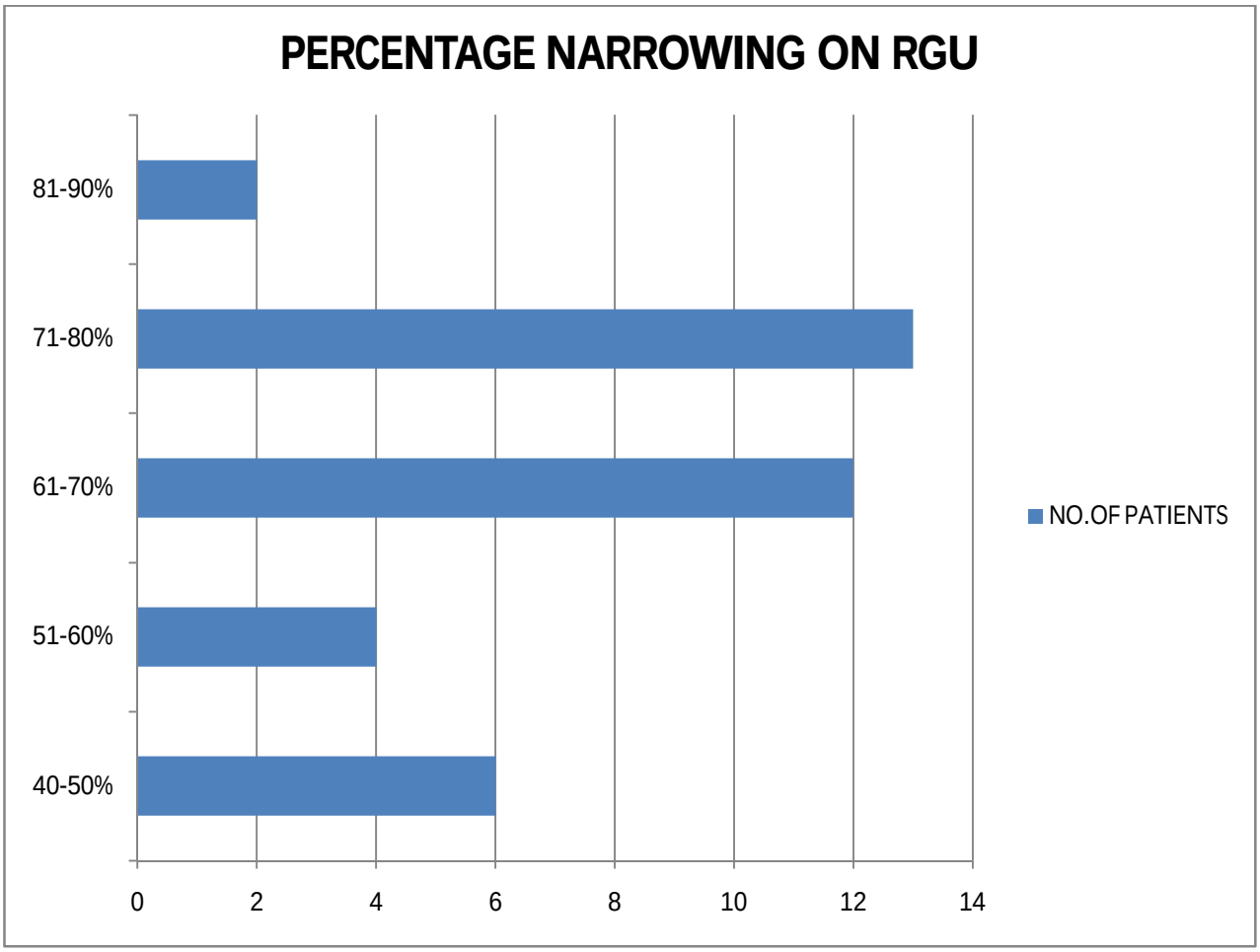


BAR DIAGRAM SHOWING STRICTURE LENGTH

PERCENTAGE NARROWING ON RETROGRADE URETHROGRAM

Percentage narrowing	Number of patients	Percentage
40 – 50 %	6	16%
51 – 60 %	4	12%
61 – 70 %	12	32%
71 – 80 %	13	35%
81 – 90 %	2	5%

The percentage narrowing was calculated from the retrograde urethrogram as described previously with the help of a scale or a vernier calipers. It was found that out of the 37 cases, 13 patients had a narrowing in the range of 71 – 80%; 12 patients in the range of 62 – 70%; 6 patients in the range of 40 – 50%; 4 patients in the range of 51 – 60% and 2 patients in the range of 81 – 90%.

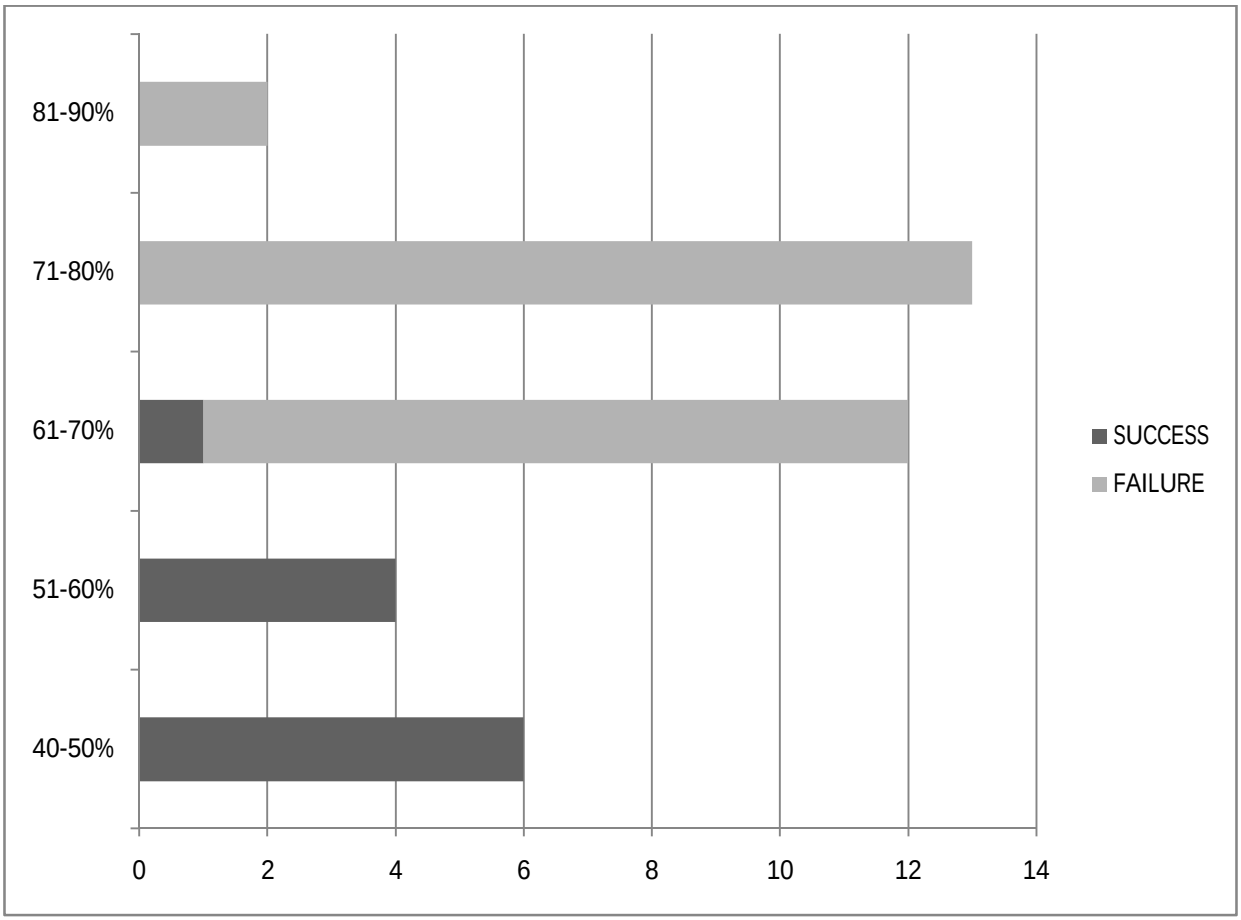


BAR DIAGRAM SHOWING THE PERCENTAGE NARROWING

TREATMENT RESULT ACCORDING TO PERCENTAGE NARROWING ON THE RETROGRADE URETHROGRAM

Percentage Narrowing	Treatment Success	Treatment Failure
40 – 50%	6	-
51– 60%	4	-
61 – 70%	1`	11
71 – 80%	-	13
81 – 90%	-	2

In our study, out of the 11 patients who did not have recurrence, 6 patients had a percentage narrowing in the range of 40 – 50%; 4 patients had a percentage narrowing in the range of 51 – 60% and one patient had a percentage narrowing in the range of 61 – 70%.

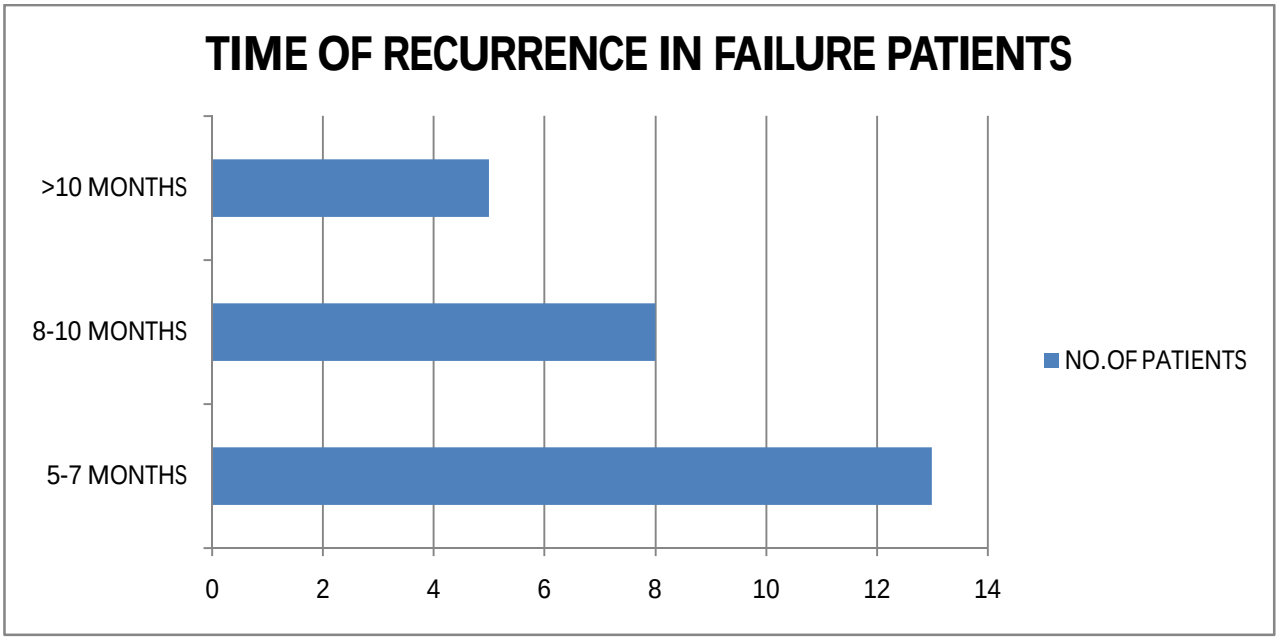


BAR DIAGRAM SHOWING THE TREATMENT RESULT ACCORDING TO THE PERCENTAGE NARROWING ON THE RETROGRADE URETHROGRAM

TIME OF RECURRENCE IN FAILURE CASES

Time of Recurrence	Number of Patients
5 – 7 months	13
8 – 10 months	8
>10 months	5

Most of the recurrences in the failure patients occurred in the first 5 to 7 months. In our study, out of the 26 treatment failure cases, around 13 patients failed in the first 5 to 7 months. Around 8 patients failed in the first 8 to 10 months and the remaining 5 failure patients had recurrence after 10 months.



BAR DIAGRAM SHOWING TIME OF RECURRENCE IN FAILURE

PERCENTAGE NARROWING ON RETROGRADE URETHROGRAM - Outcome Crosstabulation

			Outcome		Total	P value
% On RGU	<= 60	Count	8	1	9	<0.001**
		% within % On RGU	88.9%	11.1%	100.0%	
		% within Outcome	72.7%	3.8%	24.3%	
	> 60	Count	3	25	28	
		% within % On RGU	10.7%	89.3%	100.0%	
		% within Outcome	27.3%	96.2%	75.7%	
Total		Count	11	26	37	
		% within % On RGU	29.7%	70.3%	100.0%	
		% within Outcome	100.0%	100.0%	100.0%	

*NOTE: ** DENOTES SIGNIFICANT AT 1% LEVEL*

DISCUSSION

Optical Internal Urethrotomy is a very safe and relatively easy procedure to perform and to learn. This attribute has made it as the procedure of choice among many urologists worldwide for the treatment of short segment bulbar urethral stricture. But when juxtaposed with urethroplasty, the success rate of Optical Internal Urethrotomy is modest, ie., 50% compared with 83% at 5 years and at 10 years it is around 33 %. Although Optical Internal Urethrotomy is being employed so widely, the fact remains that strict guidelines governing the indications and the frequency of Optical Internal Urethrotomy are lacking. Similarly, there may be evidence in literature to suggest that repeat Optical Internal Urethrotomy may actually aggravate the condition of the stricture. Therefore it is wise to have some parameters that may be employed to predict the outcome of Optical Internal Urethrotomy in a particular patient so that it may be used more judiciously and on evidence basis.

Objective variables that may forecast a better or a poorer outcome in a particular patient undergoing Optical Internal Urethrotomy may be extremely useful in patient selection and avoidance of unnecessary OIU.

The commonest imaging done to evaluate a patient of stricture urethra is Retrograde Urethrogram. But a minor disadvantage with it is that at times it may

underestimate the true length of the stricture. Inspite of the above minor disadvantage, in regular urological practice it is the commonest imaging modality employed to decide upon Optical Internal Urethrotomy as a management choice for short segment bulbar stricture.

The wall of normal urethra is relatively thin, smooth and pliable as evidenced by a normal Retrograde Urethrogram. But in cases of stricture or any other urethral pathology, there is frequently fibrosis of the wall of the urethra thus making it non-pliable and thick-walled. This fibrosis of the corpus spongiosum can be objectively assessed by the extent of the narrowing of the urethral lumen on Retrograde Urethrogram. In other words, the degree of spongiofibrosis is considered to be a crucial parameter that influences appropriate choice of treatment and the outcome.

Usually, sonourethrogram is the modality that has been traditionally used by urologists to assess the degree of spongiofibrosis at the stricture site by comparing the lumen at the stricture site with that of the normal urethra distal to the stricture site. Although sonourethrogram is a good investigation to assess the degree of spongiofibrosis, it is hampered by the fact that it is not widely available, it is more operator dependent and has a relatively low sensitivity and specificity.

Our present study which employs the technique of measuring the percentage narrowing at the site of maximal narrowing on the retrograde urethrogram is more or less an extension of the scientific precept of assessing spongiofibrosis on a sonourethrogram.

As in sonourethrogram where the degree of spongiofibrosis is measured by measuring the degree of encroachment of the lumen at the stricture site, here also the narrowing at the maximal stricture site is measured on the Retrograde urethrogram. In other words, the extent of the luminal narrowing on the retrograde urethrogram may be considered a surrogate marker for the degree of spongiofibrosis at that site. It should also be remembered that this measurement is usually not influenced by the position of the patient since the direction of the x-ray beam is almost at right angles to the length that is measured.

In our study, the degree of narrowing or in other words, the percentage of narrowing at the maximal stricture site on the retrograde urethrogram was found to be associated with the outcome of Optical Internal Urethrotomy .

Out of the 37 patients who had undergone Optical Internal Urethrotomy in our study period, 11 patients who had a narrowing of less than 70% had a good outcome. In particular, all the 10 patients who had a narrowing in the range of 40 – 60% had good outcome with no recurrence till date. On the other hand, out of the

remaining 27 patients who had a narrowing of more than 60 % on the Retrograde Urethrogram 26 patients had treatment failure and required repeat treatment at some point during the follow-up.

Thus this method of using the percentage narrowing at the stricture site on a good Retrograde Urethrogram is a very useful method of judging the degree of spongiofibrosis at the stricture site which in turn can be used to predict the outcome of Optical Internal Urethrotomy .

Factors which can influence the measurement are under-distension and over-distension of the distal urethra thus affecting the calculation of the percentage since the lumen of the distal urethra forms the denominator in our calculation. In order to ascertain correct filling of the distal urethra, a few hints may be taken into consideration. If there is entry of contrast into posterior urethra, it suggests a correct filling the distal urethra. In the same way if there is intravasation of contrast, it denotes overfilling and such urethrograms must be excluded and a fresh retrograde urethrogram may be ordered.

Other factors like length of the stricture, site of the stricture and etiology of the strictures being equal, the degree of narrowing on the Retrograde Urethrogram may play a crucial role in the result of Optical Internal Urethrotomy . Thus it may

be used in prognosticating or predicting the outcome of Optical Internal urethrotomy.

Studies have also indicated that a repeat Optical Internal urethrotomy does not alter the overall results, thus a repeat Optical Internal Urethrotomy may not afterall be a good option in cases of failures.

Though there is nothing in the literature to say that multiple Optical Internal Urethrotomies may influence the outcome of a future urethroplasty, it would be prudent to restrain from doing multiple OIUs in a particular patient as there is a chance of worsening the fibrosis and increasing the length of the stricture thereby precluding the possibility of a anastamotic urethroplasty and necessitating a substitution urethroplasty.

Based on our present study, though the sample size is not great, there is a rough indication that those patients with a percentage narrowing of less than 60% on the Retrograde Urethrogram had a better outcome with Optical Internal Urethrotomy than those with a percentage narrowing of more than 60%. This result was found to be statistically significant with a p-value of <0.001**.

One of the limitations which we had encountered in our study was in the follow-up of the patients and the compliance of the patients to our instructions. Though we had given explicit instructions to the patient with regard to the follow-

up timetable, many patients turned up late and a few did not turn up at all who were excluded from the study. In the same way, though the patients were properly instructed and demonstrated on the Clean Intermittent Self Catheterisation technique, a few patients had not performed it. Another issue was the tool used to measure the degree of narrowing on the Retrograde Urethrogram. Vernier calipers or a conventional foot scale was used for measuring. Sometimes the x-ray quality was not good enough to allow precise measurement of the degree of narrowing especially conventional film x-rays. With digital x-rays it was possible to measure the narrowing on the console. These issues may have to be addressed and taken into consideration when conducting and interpreting any study of this nature and similarity.

CONCLUSION

Though Optical Internal Urethrotomy is a simple and safe procedure for bulbar urethral stricture patients it should not be used indiscriminately. Improper selection of patients may necessitate multiple procedures on the same patient thus adversely affecting the quality of life and economic well-being of the patient.

An easy way to assess the degree of spongiofibrosis without using a sonourethrogram is calculating the percentage narrowing at the maximal site of stricture on a Retrograde Urethrogram. This may be used to predict the outcome after Optical Internal Urethrotomy. In our study, patients with percentage narrowing of less than 60% on Retrograde Urethrogram had a better outcome than patients who had a percentage narrowing of more than 60% (p-value 0.001**). Thus alternate treatment may be considered for such patients who have a high degree of narrowing on the Retrograde Urethrogram.

ANNEXURE

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MASTER CHART

S.NO	NAME	AGE	IP NO	ETIOLOGY	LENGTH (CM)	% ON RGU	PVR PREOP	PVR POSTOP	UROFLOW PREOP			UROFLOW POST OP			UROFLOW 3 MONTHS			UROFLOW 6 MONTHS			RECURRENCE (MONTHS)	RESULT (18 MONTHS)
									PF	MF	VV	PF	MF	VV	PF	MF	VV	PF	MF	VV		
1	Mr. Jayaraman	40	8833	idiopathic	< 1	90%	150	30	9	5	150	16	10	170	17	11	160	na			6	F
2	Mr Devaraj	40	9746	traumatic	>1	80%	205	60	6	5	110	17	12	120	17	11	185	na			7	F
3	Mr Kumar	72	9377	idiopathic	<1	70%	170	20	6	4	160	14	9	200	16	10	240	15	11	190	9	F
4	Mr Shahul hamid	58	8831	LS	>1	70%	110	10	7	5	160	12	10	140	11	7	160	na			8	F
5	Mr Dharmalingam	47	21728	LS	>1	80%	225	40	9	6	140	11	9	220	14	10	250	na			7	F
6	Mr Veeran	56	27472	Idiopathic	<1	80%	300	10	9	6	140	16	12	180	na			9	5	170	7	F
7	Mr Kasi	35	24067	traumatic	>1	50%	190	10	9	7	210	16	10	210	na			15	10	310	nil	S
8	Mr Janakiraman	35	31951	traumatic	<1	50%	225	20	11	9	140	15	12	170	18	10	220	15	9	320	nil	S
9	Mr Parthiban	27	32948	idiopathic	<1	70%	110	60	9	5	210	16	11	210	15	10	170	14	10	250	8	F
10	Mr Shankar	35	34552	idiopathic	>1	84%	190	20	5	3	160	14	10	190	17	10	180	na			6	F
11	Mr John	49	40382	traumatic	>1	60%	80	5	9	6	210	14	12	240	14	12	190	17	10	210	nil	S
12	Mr Babu	45	40383	idiopathic	<1	65%	140	15	9	6	190	15	10	250	19	11	220	15	10	240	nil	S
13	Mr Selvam	49	40971	idiopathic	<1	80%	220	20	10	5	150	14	11	170	17	10	210	16	10	180	nil	S
14	Mr Ramu	40	45065	traumatic	>1	60%	80	30	11	9	210	15	12	220	17	10	310	15	10	210	nil	S
15	Mr Murugan	65	46586	idiopathic	<1	60%	130	30	5	2	150	16	12	260	14	10	210	12	10	240	10	F
16	Mr Guruvappa	53	44026	idiopathic	>1	60%	160	110	9	6	150	14	9	160	18	12	320	15	10	250	nil	S
17	Mr Muniyandi	60	49308	traumatic	>1	80%	230	20	6	5	120	15	11	190	17	6	210	12	11	160	8	F
18	Mr Babu	32	53339	idiopathic	<1	90%	300	60	5	3	140	13	9	210	11	6	210	na			5	F
19	Mr Ibrabhim	33	49078	traumatic	>1	80%	110	10	8	4	200	14	9	230	15	10	260	14	10	170	8	F
20	Mr Shenbagam	74	51627	traumatic	>1	70%	300	5	6	4	120	15	11	180	17	10	260	na			6	F
21	Mr Chinnaiyhan	65	54268	idiopathic	>1	70%	110	10	5	4	160	14	12	170	15	11	200	14	10	190	9	F
22	Mr Babu	25	55025	LS	>1	70%	140	30	5	4	200	11	9	160	12	9	160	6	4	120	5	F
23	Mr Ravi	41	51202	iatrogenic	<1	50%	110	10	10	8	200	16	12	260	17	12	220	16	12	200	nil	S
24	Mr Mani	40	7060	traumatic	>1	50%	70	25	6	3	140	15	10	190	15	11	330	na			nil	S
25	Mr Gaja	31	9831	traumatic	>1	40%	120	10	5	4	130	16	11	200	17	12	220	15	11	330	nil	S

MASTER CHART

S.NO	NAME	AGE	IP NO	ETIOLOGY	LENGTH (CM)	% ON RGU	PVR PREOP	PVR POSTOP	UROFLOW PREOP			UROFLOW POST OP			UROFLOW 3 MONTHS			UROFLOW 6 MONTHS			RECURRENCE (MONTHS)	RESULT (18 MONTHS)
									PF	MF	VV	PF	MF	VV	PF	MF	VV	PF	MF	VV		
26	Mr Munusamy	35	10474	traumatic	>1	80%	220	50	9	6	210	15	10	190	14	9	110	17	11	180	10	F
27	Mr Sathish	26	26140	idiopathic	<1	85%	190	25	6	4	130	14	11	140	15	10	210	13	9	170	7	F
28	Mr Arulanandan	65	32781	iatrogenic	>1	70%	100	30	6	2	160	15	10	240	17	11	180	na			9	F
29	Mr Venkatesh	35	33330	iatrogenic	>1	70%	80	10	6	3	210	15	9	170	12	8	320	14	9	210	11	F
30	Mr Soosairaj	54	36375	idiopathic	<1	70%	105	20	9	1	210	14	10	210	17	9	130	na			nil	S
31	Mr Sivakumar	39	42152	iatrogenic	>1	75%	90	40	6	3	130	15	10	250	15	11	230	14	9	90	11	F
32	Mr Marimuthu	40	51682	iatrogenic	>1	75%	110	10	9	6	150	16	11	260	19	11	310	na			12	F
33	Mr Murugavel	46	53895	idiopathic	<1	80%	90	20	6	4	110	15	10	190	17	11	210	14	11	140	11	F
34	Mr Panneerselvam	65	28435	LS	>1	84%	160	30	8	4	150	14	9	240	19	11	150	9	6	240	6	F
35	Mr Venkatesan	25	27416	LS	<1	80%	120	5	6	3	155	15	11	190	18	11	150	na			7	F
36	Mr Thangaraj	43	4109	LS	>1	70%	140	5	8	4	220	12	8	210	14	11	310	na			6	F
37	Mr Sampath	70	11539	iatrogenic	<1	70%	130	60	8	4	140	15	10	150	18	11	310	na			6	F

PVR - Post Void Residual
PF - Peak Volume
MF - Mean Volume
VV - Voided Volume
LS - Lichen Sclerosus
RGU - Retrograde Urethrogram
F - Failure
S - Success
Na - Not Available

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predicting outcome of internal urethrotomy based on percentage narrowing on the RGU by 18112555 - Mch Urology Karthik. VC

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INTRODUCTION Urethral stricture is a relatively common urological disorder which every urologist encounters in his regular urological practice. They pose a significant problem from both clinical and economic burden point of view. It is a very ancient disease. It has even been described by sushruta, the ancient Indian surgeon, as mutra marga sankocha; it was treated with dilatation with a stick lubricated with ghee. The incidence of urethral stricture can only be estimated at best. In the west, the incidence is around 0.6 %. The incidence is probably higher in india. The etiology of stricture urethra has changed over times. Trauma has taken over infection as the commonest cause. The trauma can be either external (trauma) or internal (instrumentation). Another important cause is BXO also called as lichen sclerosus. In a small group of patients, no particular cause can be made out and they are grouped under ‘idiopathic’. The management of stricture has also evolved over the times. From lubricated reed in the times of sushruta the treatment has increased in complexity to the present day urethroplasties. Despite the availability of various options for the treatment of stricture urethra, internal urethrotomy has remained as a popular option among the urologists in view of its simplicity,safety and shorter learning curve. Despite its popularity, the success rates of internal urethrotomy is not very encouraging compared to urethroplasty. The reported success rates of internal urethrotomy varies from 60 to 90%. Various factors responsible for recurrence have been investigated like age of the patient, length of the stricture, site of the stricture, amount of the peri-urethral scarring, diameter of the stricture etc. Among these various factors, the diameter of the stricture or in other words the percentage of narrowing at the point of the maximum stricture is the least studied. REVIEW OF LITERATURE EPIDEMIOLOGY OF URETHRAL STRICTURE DISEASE DEMOGRAPHICS In the west, stricture urethra is more prevalent in the aged population. The incidence increases as the age increases.

The disease is more often treated at tertiary centres rather than primary or secondary centres. In contrast, in third world countries, the disease is by and large due to infectious, inflammatory or traumatic in origin and tends to affect younger population. INCIDENCE It is difficult to measure the incidence of stricture urethra. In the west, the incidence rate is more (0.6%) and in excess of 5000 inpatient visits per year have been recorded. But of late, the incidence has come down in the west owing to increasing use of anastamotic and substitution urethroplasty procedures. But in india, male stricture urethral disease remains to be common; trauma and inflammatory being the important causes. Most often the disease is treated by conservative or minimally invasive techniques like dilatation or internal urethrotomy and hence the recurrence rates are high. PRESENTATION The patients usually complain of obstructive LUTS like weak stream, straining, hesitancy, intermittency, post-void dribbling, increased frequency, dysuria. Symptoms may be worsened by formation of secondary vesical calculus. They mimic symptoms of prostatomegaly in aged people. In young males they may cause anejaculation and therefore infertility. Epididymitis is another manifestation of an undiagnosed stricture. Another devastating sequelae of untreated, undiagnosed stricture disease is fourniers gangrene. Induration may be felt along the urethra on palpation. PATHOLOGY The normal urethra is lined by peudostratified columnar epithelium. Deeper to this epithelium lies a layer of connective tissue rich in blood supply and smooth muscle. The connective tissue harbours rich amount of fibroblasts bathed in a matrix of collagen, proteoglycans, elastic fibres. And this connective tissue layer is the site of main pathology in stricture urethra. Spongiofibrosis of the connective tissue is the hallmark of urethral stricture disease. ETIOLOGY The most common cause for stricture today in developed and developing countries is trauma. The trauma may be external trauma (RTA with pelvic fracture or straddle injury) or internal trauma (instrumentation). Another meta-analysis has shown that the causes of stricture are iatrogenic, idiopathic, trauma and inflammation in decreasing order of frequency. The stricture site also differs across various studies; but, by and large, strictures are found most commonly in Bulbar, followed by penile strictures. In a few cases they are mixed, ie., both anterior and posterior. Meatal or sub-meatal strictures also form a small percentage. Gonococcal strictures are no longer common. The most common cause of inflammatory stricture appears to be

3**Lichen Sclerosus Atrophicus (LSA).** LSA **is a chronic inflammatory disease of** idiopathic **etiology** which begins in **the**

glans, meatus and prepuce. Clinically it appears as a whitish plaque often causing a phimosis. It can also involve perimeatal area and in course of time, the fossa navicularis and distal anterior urethra also get involved probably due to high pressure voiding. A pan-urethral stricture may also ensue secondary to the high pressure voiding due to LSA. Strictures found in the fossa navicularis are usually secondary to either inflammatory or instrumentation. The procedures incriminated in the causation of stricture are Trans- Urethral Resection of Prostate, prolonged catheterization, cystoscopy, prior hypospadias surgery in decreasing order of frequency. Radical prostatectomy causes stricture in a small percentage of patients. Strictures secondary to instrumentation occur due to ischemia at the site of greatest pressure. These pressure points are usually found at fossa-meatus, bulbo- membranous junction and peno-scrotal junction. The above picture shows the sites of the ischemic strictures following instrumentation. Prolonged catheterization is another important cause for stricture. The pathophysiology may be traumatic insertion, the catheter material may elicit an inflammatory response from the urethra or may be due to ischemia of the surrounding urethra due to placement of a large-calibre catheter. IMAGING OF THE URETHRA Of the numerous imaging modalities

available to image the urethra, the most commonly used modalities are retrograde urethrography (RGU) also called as ascending urethrography and the voiding cystourethrography (VCUG). Other modalities which are slowly gaining ground are the Sonourethrography, MRI and CT. By imaging, one aims to determine the presence of stricture, its number, site, length and depth. Usually RUG and VCUG suffice to garner the above information but sonourethrogram and MRI may be used in special situations especially when the degree and depth of the spongiofibrosis have to be assessed. Before going into the imaging of the urethra it may be appropriate to review the anatomy of the male urethra. The urethra is traditionally divided into four segments namely, the prostatic

2**urethra, the membranous urethra, the** bulbar **urethra and the**

2**penile or** the **pendulous urethra. The** prostatic and **the membranous urethra** are grouped as **the** posterior **urethra** while **the**

bulbar and the penile urethra are grouped as the anterior urethra. The penile urethra lies within the penis and is the longest segment of the urethra. The distal penile urethra consists of a focally dilated area near the meatus called the fossa navicularis . The bulbar urethra lies proximal to the penile urethra and is separated from it at the peno-scrotal junction. The bulbar urethra happens to be the most distensible part of the urethra. The bulbar urethra as it transitions into the membranous urethra assumes a conical shape at the bulbomembranous junction. This ‘coning’ of the bulbo- membranous junction is an important landmark on the urethrogram. The membranous urethra is the least distensible segment of the urethra as it courses its way through the urogenital diaphragm. The prostatic part of the urethra lies proximal to the membranous urethra. A small hillock of tissue on the posterior aspect of the luminal surface of the prostatic urethra, often visualized as a filling defect on the urethrogram, is the verumontanum. On a urethrogram, the junction between the membranous and the prostatic urethra can be identified using a useful landmark. An imaginary line made across the inferior border of the obturator foramina intersects the bulbo-membranous junction. RETROGRADE URETHROGRAPHY RUG is the most basic investigation for the urethra. For this test, the patient is made to lie in a semi-supine position with a 45 degree tilt and the lower thigh and knee are flexed. This position is important to get a proper image and it also overcomes the fore- shortening which may occur otherwise. The glans penis is properly cleansed and then a small feeding tube or a small foley catheter is gently placed into the fossa navicularis and the balloon inflated with 1-1.5 ml of water. After this, the contrast agent amounting to around 20 ml is gently introduced into the urethra taking efforts and measures to eliminate air bubbles. And the radiographer is asked to take the image. VOIDING CYSTOURETHROGRAPHY It can be combined with retrograde urethrography when it is called as ‘opposing urethrogram’ or ‘up and down –o-gram’ which is useful to assess posterior urethral distraction defects. VCUG is used to assess the posterior urethra. In normal voiding, there is opening of the bladder neck and distension of the prostatic urethra. The procedure involves filling of the bladder with contrast instilled through a urethral Foleys catheter or through a spc catheter. Once the bladder is filled, the urethral Foleys catheter is removed. The position of the patient is the same as that of the RUG. The patient is requested to void into a container. Or the patient may be asked to void in a standing position. Radiographs are taken when the patient is voiding. Additional films are taken after the bladder is emptied. SONOURETHROGRAPHY It is not used for routine imaging for

urethra. It is useful when one wants to determine the degree of spongiofibrosis around a stricturous segment. It is particularly useful for characterization of the bulbar urethra. To do this test, first the urethra is instilled with sterile saline through a Foleys catheter. The penis is made to lie on the abdomen and with the help of a high frequency (7.5 MHz) linear transducer which is placed on the ventral aspect of the penis the urethra is insonated. To insonate the bulbar urethra the probe is placed onto the perineum. The sonourethrography is a more precise tool to assess the stricture length as there is no foreshortening of length as in RUG; this attribute of sonourethrogram gains more prominence when dealing with the bulbar urethra as foreshortening with RUG is more common in this segment. Another important use of sonourethrography is in determining the degree of spongiofibrosis which a RUG cannot throw light upon. As we will see, the degree of spongiofibrosis is directly proportional to the chances of recurrence following internal urethrotomy. On the sonourethrogram, areas of spongiofibrosis appear as areas of hyperechogenicity; normal spongiosum is hypoechoic. The above picture shows a mound of tissue along the dorsal aspect of the bulbar urethra (arrows) causing a mild stricture. The downside of sonourethrography is its limited availability, lack of expertise in handling the procedure and the cost. MRI MRI is rarely used in the evaluation of stricture urethra. It is used in very specific situations in centres where it is available. It may be especially useful in assessing posterior urethral trauma and as with sonourethrography it may be useful in determining the spongiofibrosis. Both T1 and T2 weighted images are used and if necessary gadolinium based contrast can be used. To view the posterior urethra, coronal or axial images may be taken and to view the anterior urethra sagittal views are ideal. For more accurate viewing dilute gadolinium contrast may be instilled into the urethra after which the penis is clamped with a special clamp which does not hamper the performance of the MRI and then fat saturated T1 weighted images are taken. CLASSIFICATION OF STRICTURE URETHRA Stricture urethra results from scarring of the epithelium lining the urethra and is found to encroach into the deeper spongiosal layer. What we call as the stricture is constituted of collagen fibres and fibroblasts. It can circumferentially contract thereby abbreviating the urethral length which results in constriction of the urethral lumen. It has been found over the course of urological practice that the patients suffering from stricture disease become symptomatic only the lumen size exceeds 16 fr. Several classification systems have been proposed by various people over the years. The one proposed by Devine et al (*), classified strictures based on the degree of the spongiofibrosis. They classified strictures from A to F with A type stricture having no spongiofibrosis and F type stricture having spongiofibrosis affecting the entire corpus spongiosum with potential fistula formation. But the practical difficulty in adopting the above classification is that the degree of spongiofibrosis cannot be reliably and consistently determined by routine and non- invasive means. One of the proven methods to determine spongiofibrosis is sono- urethrogram but it may not be available in all the institutions where stricture surgery is practiced. Moreover, it is subjective and depends on the experience of sinologist. Presence of urethral induration on palpation and elasticity of the urethral lumen at the time of urethroscopy have been proposed as markers for the underlying fibrosis. But again these parameters are not always foolproof. Another classification system for stricture was proposed by McAninch(*) in the year 1988 which is based on the configuration of the urethral lumen as seen on the sono- urethrogram. Accordingly, strictures were classified from mild to severe; mild type having less than one third of lumen occlusion while the severe type having more than half of the lumen occluded. Barbagli, an Italian urologist, recommended a staging system for strictures caused by LSA when it affects the penile urethra(*). According to his system, stage 1 involves the prepuce, stage 2 involves in addition to the prepuce, the meatus and the corona, stage 3 involves, in addition to the above, the fossa navicularis and the anterior urethra. Stage 4 is associated with a precancerous or a cancerous lesion. COMPLICATIONS OF STRICTURES Stricture disease if left undiagnosed and untreated may result in

deleterious complications like UTI, vesical calculi, formation of urethral diverticulum, urethro- cutaneous fistulae. When numerous urethro-cutaneous fistulae occur in the perineum it is known by the eponym 'watering can perineum". Extravasation due to stricture or dilatation of stricture can be disastrous and if infected may result in fourniers gangrene. Another lethal complication of a long-standing stricture is urethral cancer. ECONOMIC IMPACT As mentioned earlier, urethral stricture disease is prevalent in third world countries like india. The number becomes swollen when one considers the fact that compared to west most of the stricture cases are managed conservatively or with minimally invasive procedures like dilatation or internal urethrotomy and hence the recurrence rates are high. These facts when translated into economic impact, urethral stricture disease really becomes an important disease from loss of economy point of view. A study from rourke and Jordan(*), has shown that urethroplasty is economically cheaper than OIU unless the recurrence rate with OIU becomes less than 60%. Another study by Wright et al. (*), has shown that the most cost effective approach may be one session of optical urethrotomy followed by urethroplasty if stricture recurs. In a country like India, where most of the strictures are still treated by OIU with high recurrence rates, economic burden is still higher considering the fact that each session of OIU entails a period of admission in the hospital with loss of man-years. These above facts re-emphasise the need for proper selection of procedure for each patient of stricture urethra. MINIMALLY INVASIVE PROCEDURES FOR STRICTURE URETHRA Urethral dilatation and Optical Internal Urethrotomy are the two most commonly performed minimally invasive procedures for stricture urethra worldwide. They may be used for the initial treatment of stricture disease with equal effect. The efficacy of OIU is different in different studies, ranging from 60% to 90% with efficacy dropping with longer follow-up. DILATATION Dilatation as a treatment for stricture urethra is as old as the disease itself. It has been mentioned even by sushruta where a reed lubricated with ghee was used as the method of dilatation. With better understanding of the anatomy of the urethra, the instrumentation for dilatation has also improved over the ages. Dilatation may be effected by a variety of instruments viz., sounds, bougies, filiforms and followers, amplatz dilators or balloon dilators. Whatever the instrument, the aim of dilatation is to stretch the scar tissue without rupturing it. If it ruptures, the resulting injury will heal with more fibrosis and may actually worsen the stricture. The safest way to effect a dilatation is to serially dilate the stricturous area with increasing caliber of the dilator. The dilators usually used in dilatation clinics are metal dilators with a curved tip. Too thin a dilator may produce a false passage; hence it is wiser to start with a medium-size dilator. It may be enough to dilate upto 24fr. Balloon dilators are a recent introduction; they may be less traumatizing, but the down-side being the requirement of fluoroscopy. OPTICAL INTERNAL URETHROTOMY OIU is best suited for single, bulbar strictures shorter than 2 cm, with minimal spongiofibrosis and with no past OIU. OIU may be contra-indicated in suspected urethral malignancy, coagulation disorders or active infection. OIU is not suited for long strictures (>2 cm), multiple strictures, previous OIU, strictures other than bulbar where the recurrence rate may be high and unacceptable. OIU, as mentioned previously, is favoured by many urologists because of its simplicity, shorter learning curve, less complications. Hence it may be the case where OIU is being used indiscriminately by urologists across the world especially in less developed countries. The present day technique of OIU was introduced by Hans Sachse of Germany. He designed the cold knife what we use today and it has stood the test of time to this day. The technique of OIU is not very difficult to master. The urethrotome with the sachse knife mounted over a 0 or 30 degree telescope is introduced into the urethra; it is important to keep the knife withdrawn. As soon as the stricture site is seen, a guide wire or ureteric catheter is passed through the narrowing upto the bladder. Then with the cold knife incisions are made over the stricturous area till the normal appearing normal caliber urethra is seen. The incision is usually made at the 12 o' clock position because it is felt that the risk of bleeding is less as there is less chance of injuring

the corpora cavernosa at that location(*). Some urologists have advised multiple radial incisions at 6,9 or 12 o' clock positions citing better results. But recent studies have repudiated this and shown that the results are not much different (*). Colour Doppler ultrasound may be employed to evaluate the spongiofibrosis around the stricturous areas and also the location of the urethral arteries so that the site of urethrotomy incision can be chosen without injuring the urethral arteries(*). The catheter may be kept for a variable period following OIU. Contrary to popular belief that retaining the catheter for a longer period will cause moulding of the urethral lumen around the catheter resulting in a better result, it has been found that leaving the Foleys for more than three days actually produces less favourable results. A period of three days of catheterization following OIU has been shown to give better results. Most urologists follow a period of around 4 days of catheterization following OIU. OTHER METHODS OF URETHROTOMY OTIS URETHROTOMY – it is a blind technique. A special instrument called as OTIS URETHROTOME which can be opened to a maximum diameter of 45 fr is introduced in a closed position with a knifed mounted on it. The instrument is introduced upto the peno scrotal junction and is opened upto its maximum size of 45 fr and the knife is withdrawn. This produces a clean, linear cut in the urethra at the 12 o' clock position. Recently it has been advocated to open the urethrotome upto 35 fr only. Otis urethrotomy has been regularly used by many urologists just before TURP to prevent stricture. LASER URETHROTOMY – laser energy sources used are Nd-Yag, holmium, KTP, argon. Circumferential cutting of the stricture is done. Despite initial optimism, results have not been superior to conventional cold knife OIU. COMPLICATIONS DILATATION – false passage, bleeding , extravasation are the some of the important complications encountered when dilatation is done forcibly by an inexperienced urologist. Post procedure infection is another complication which can occur. OIU – as mentioned previously, OIU is a relatively safe procedure. Complication rate of < 10% has been reported (*). Peri-operative infection has been reported to be as high as 38% in one series(*). Some of the other complications are fever, extravasation, bleeding, chordee. Erectile Dysfunction is a rare but potentially disastrous complication which can occur. It may be due to direct cutting of the cavernous nerves at 3 and 9 o' clock positions. It can also occur by extravasation followed by fibrosis around the area of the cavernous nerves. Rarely a shunt between the corpora cavernosa and spongiosum may be created giving rise to ED. Acute renal shutdown can also occur due to extravasation followed by infection. Hence it is always better to use normal saline as the irrigant. RESULTS – despite intial optimism, the enthusiasm for OIU has subdued due to its varied and unpredictable success rate. Various series have shown various results with as low as 35% upto 90%. The recurrence rate increases as the patients are followed up longer. After 5 years, the success rate is only 25% (*). Strictures can recur even after many years following OIU. Hence a minimum follow-up for 10 years is recommended. LONG-TERM OUTCOME AFTER OIU – the long term results of OIU are not very flattering. According to a study by Albers (*) in Germany, a total number of 937 patients were managed with OIU at two centres across Germany. The average follow-up was 54 months and 38 months in each centre. The recurrence rate at the first centre with a follow-up of 54 months was found to be 26.9% while the recurrence rate at the second centre with a follow-up of 38 months was found to be 44.6%. a further analysis of the patients at the two centres revealed that the first centre had a more number of idiopathic strictures while the second centre had a more number of iatrogenic strictures. Hence the natural conclusion by the authors was that idiopathic strictures had a more successful outcome after OIU. According to another study by pansodoro (*), a total number of 224 patients with stricture urethra were enrolled; patients had strictures from various causes. All the patients were managed by OIU. The patients were followed up for a period of 98 months; the recurrence rate was found to be 68%. On further analysis, it was found that bulbar strictures had a recurrence rate of 54%, penile strictures had a recurrence rate of 84% while bulbo-penile strictures had a recurrence rate of 89%. Bulbar strictures with first time strictures,

strictures which were less than 1 cm and strictures with a diameter of more than 15 fr were found to have a more favourable outcome. Another important information obtained from this study is that strictures recurred even after 8 years after OIU. This strongly emphasizes the necessity of long term follow-up of patients after OIU. Another study by Santucci (*), a total number of 76 patients who had undergone OIU were followed. It was found that only around 8% of patients were recurrence free after a period of 5 years. RISK FACTORS FOR RECURRENCE Factors like age of the patient, chronicity of symptoms and etiology of stricture have been shown to have no bearing on the results of OIU. On the other hand, the important factors which may influence the outcome of OIU are the following. PREVIOUS OIU – most series have shown that the recurrence rate is high with history of one or multiple sessions of OIU. In one series, recurrence rate was 25% for primary OIU and 55% for secondary OIU(*). SPONGIOFIBROSIS – it has been indubitably established that the degree of spongiofibrosis around the stricture area determines the efficacy of OIU (*). Strictures with dense spongiofibrosis around the stricture area do not do well with OIU and require urethroplasty. LENGTH OF STRICTURE – several studies have shown that strictures measuring greater than 2-4 cm do not do well with OIU and recurrence rate is high(*). SITE OF STRICTURE – it has been shown by several series that bulbar strictures respond more favourably to OIU than penile strictures because of their better vascularity(*). NUMBER OF STRICTURES – various studies have gone to show that single strictures fare better than multiple strictures with OIU(*). PERI-OPERATIVE INFECTION – untreated peri-operative infection has been shown to increase the rate of recurrence in many studies (*). CALIBRE OF STRICTURE – a single study has shown that OIU gives better results for strictures measuring more than 15 fr(*). Another study has shown that percentage narrowing at the maximum area of stricture as seen on the ascending urethrogram can be used to predict the outcome of OIU(*). PREVENTION OF RECURRENCE CLEAN INTERMITTENT SELF-CATHETERISATION (CISC) – following OIU, the patients are advised to self dilate with a 14 fr tieman catheter. The time-table for CISC is twice weekly for one month, then once weekly, or once daily for one week and then the interval may be increased to once weekly or once in a month. In a study by harris et al (*), patients on CISC for more than 12 months had a recurrence rate of only 14% compared to 40% for patients who had CISC for only 6 months. But the downside is that CISC should be continued life-long and once it is stopped the recurrence rate becomes similar to control group. Other disadvantages are the occurrence of urethral bleeding and discomfort or refusal to self dilate in some patients. CLINIC DILATATION – studies have shown the efficacy of clinic dilatations beginning two weeks after OIU. Recurrences have been found to be less with patients on dilatation compared to no dilatation. Another study has shown no difference in result when CISC was compared with clinic dilatation(*). STEROIDS – intra-urethral steroid jelly or intraurethral injection of triamcinolone at the time of OIU have also shown to reduce the reccurence rate in a few studies. A few other agents like halofuginone, botulinum toxin and mitomycin C have been used following OIU either as injection into the scar tissue or intra-urethral irrigation in a few experimental studies but are yet to enter mainstream urological practice. Endo urethral brachytherapy using iridum after OIU has been tried (*) in an experimental study with good results. FOLLOW-UP There is no fixed policy on the follow-up time-table. But since the incidence of recurrence is particularly high within the first 12 months, it has been suggested to follow-up the patient after OIU or any other urethral stricture surgery on a 3-monthly basis for the first 24 months and then on a annual basis. For OIU, length of follow-up has been suggested for a minimum of 10 years as recurrence has been observed even after several years. The patients may be followed up by both non-invasive and invasive means. NON-INVASIVE EVALUATIONS URINARY FLOW RATE – it is recorded by a uroflowmetry equipment.

1**The peak flow rate** approximately gives **an** idea **of** any **bladder** outflow

obstruction.

The normal shape of the curve is that of a bell-shape whereas that of a patient with stricture is a flat box shaped curve. Various cut-offs for peak flow values have been suggested to define stricture. But most of the studies give a cut off of Q-max > 15 ml/s with no clinical symptoms as a sign of no recurrence. A combination of uroflowmetry

1**with determination of post-void residual**

urine gives a good idea of the well-being of the patients voiding status.

1**AUA SYMPTOM SCORE AND URINARY FLOW RATE**

– one study has used the combination of

1**AUA-SSI greater than 15** and **a** Q-max **less than 15 ml/s**

to predict recurrence. INVASIVE EVALUATIONS

1**URETHRAL CALIBRATION**– it **is more accurate than urethrography** to detect **stenoses/** strictures. CYSTOSCOPY – **the**

need for cystoscopy in the follow-up for OIU is controversial. Stricture is defined as inability to pass a 16 fr scope across the lumen. URETHROGRAPHY – the regular use of retrograde urethrography during the follow-up of patients after OIU may not be feasible due to logistic constraints. It may be indicated when there is a definite clue of a recurrence through non-invasive means or when a re- operation is being contemplated. MATERIALS AND METHODS STUDY DESIGN: prospective study DURATION: September 2012 to March 2014 SETTING: Govt. Stanley Medical College and Hospital Campus INCLUSION CRITERIA: Patients with primary bulbar stricture EXCLUSION CRITERIA: 1. Patients with a history of prior intervention 2. Complete block of urethral lumen 3. Stricture greater than 2 cm METHODOLOGY: A total number of 51 patients were studied in the above specified period. All patients with primary bulbar urethral stricture were selected. Of those patients, the ones who had any prior intervention in the form of dilatation, OIU or urethroplasty were excluded. All the patients underwent a standardaised preoperative evaluation including basic urine and blood chemistries, uroflowmetry and a good quality Retrograde Urogram. On the retrograde urethrogram film, the site of the maximal narrowing was measured. The diameter of the normal lumen distal to the stricture site was also taken. The distal urethral lumen was taken as normal as this part is maximally distended while performing a urethrogram rather than the urethral proximal to the stricture. The percentage narrowing was calculated. The patients were then subjected to Optical Internal Urethrotomy. OIU was done using a standard

20 fr sachse urethrotome. Following surgery the patients were advised to self-dilate with 14 fr tieman catheter starting from the 3rd day of removal of Foleys. Foleys was removed on the 7th post-op day. The patients were advised to self dilate for once daily for the first month and then once in 3 days later. Symptom recurrence, inability to pass the tiemans catheter and the necessity for repeat OIU were taken as treatment failures. RESULTS AGE DISTRIBUTION Age in years Number of patients Percentage 21 - 30 4 11% 31 - 40 12 32% 41 - 50 10 27% >50 11 30% In our study of 37 patients, majority of the patients, ie., 32% of them were in the age group of 31 – 40 years;30% more than 50 years; 27 % in 41 – 50 years and 4 patients in the age group 21 – 30 years. ETIOLOGY Etiology Number of patients Percentage Inflammatory 15 41% Traumatic 10 27% Idiopathic 7 19% Prolonged catheterisation 5 13% In our study, the most common etiology was found to be inflammatory (41%) followed by traumatic (10%), idiopathic (19%) and finally prolonged catheterisaiton (13%). STRICTURE LENGTH Stricture length Number of patients percentage < 1cm 15 41 % 1 – 2 cm 22 59% In our study, 15 patients (41 %) had a stricture length below 1 cm and 22 patients (59 %) had a stricture length between 1 and 2 cm. PERCENTAGE NARROWING ON RGU Percentage narrowing Number of patients Percentage 40 – 50 % 6 16% 51 – 60 % 4 12% 61 – 70 % 12 32% 71 – 80 % 13 35% 81 – 90 % 2 5% The percentage narrowing was calculated from the retrograde urethrogram as described previously with the help of a scale or a vernier caliper. It was found that out of the 37 cases, 13 patients had a narrowing in the range of 71 – 80%; 12 patients in the range of 62 – 70%; 6 patients in the range of 40 – 50%; 4 patients in the range of 51 – 60% and 2 patients in the range of 81 – 90%. TREATMENT RESULT ACCORDING TO PERCENTAGE NARROWING Percentage Narrowing Treatment Success Treatment Failure 40 – 50% 6 - 51– 60% 4 - 61 – 70% 1` 11 71 – 80% - 13 81 – 90% - 2 In our study, out of the 11 patients who did not have recurrence, 6 patients had a percentage narrowing in the range of 40 – 50%; 4 patients had a percentage narrowing in the range of 51 – 60% and one patient had a percentage narrowing in the range of 61 – 70%. TIME OF RECURRENCE IN FAILURE CASES Time of Recurrence Number of Patients 5 – 7 months 13 8 – 10 months 8 >10 months 5 Most of the recurrences in the failure patients occurred in the first 5 to 7 months. In our study, out of the 26 treatment failure cases, around 13 patients failed in the first 5 to 7 months. Around 8 patients failed in the first 8 to 10 months and the remaining 5 failure patients had recurrence after 10 months. DISCUSSION Optical Internal Urethrotomy is a very safe and relative easy procedure to perform and to learn. This attribute has made it as the procedure of choice among many urologists worldwide for the treatment of short segment bulbar urethral stricture. But when juxtaposed with urethroplasty, the success rate of OIU is modest, ie., 50% compared with 83% at 5 years and at 10 years it is around 33 %. Although OIU is being employed so widely, the fact remains that strict guidelines governing the indications and the frequency of OIU are lacking. Similarly, there may be evidence in literature to suggest that repeat OIU may actually aggravate the condition of the stricture. Therefore it is wise to have some parameters that may be employed to predict the outcome of OIU in a particular patient so that OIU may be used more judiciously and on evidence basis. Objective variables that may forecast a better or a poorer outcome in a particular patient undergoing OIU may be extremely useful in patient selection and avoidance of unnecessary OIU. The commonest imaging done to evaluate a patient of stricture urethra is RGU. But a minor disadvantage with RGU is that at times it may underestimate the true length of the stricture. Inspite of the above minor disadvantage, in regular urological practice it is the commonest imaging modality employed to decide upon OIU as a management choice for short segment bulbar stricture. The wall of normal urethra is relatively thin, smooth and pliable as evidenced by a normal RGU. But in cases of stricture or any other urethral pathology, there is frequently fibrosis of the wall of the urethra thus making it non-pliable and thick-walled. This fibrosis of the corpus spongiosum can be objectively assessed by the extent of the narrowing of the urethral lumen on RGU. In other words, the degree of

spongiofibrosis is considered to be a crucial parameter that influences appropriate choice of treatment and the outcome. Usually, sonourethrogram is the modality that has been traditionally used by urologists to assesss the degree of spongiofibrosis at the stricture site by comparing the lumen at the stricture site with that of the normal urethra distal to the stricture site. Although sonourethrogram is a good investigation to assess the degree of spongiofibrosis, it is hampered by the fact that it is not widely available, it is more operator dependent and has a relatively low sensitivity and specificity. Our present study which employs the technique of measuring the percentage narrowing at the site of maximal narrowing on the RGU is more or less an extension of the scientific precept of assessing spongiofibrosis on a sonourethrogram. As in sonourethrogram where the degree of spongiofibrosis is measured by measuring the degree of encroachment of the lumen at the stricture site, here also the narrowing at the maximal stricture site is measured on the RGU. In other words, the extent of the luminal narrowing on the RGU may be considered a surrogate marker for the degree of spongiofibrosis at that site. It should also be remembered that this measurement is usually not influenced by the position of the patient since the direction of the x-ray beam is almost at right angles to the length that is measured. In our study, the degree of narrowing or in other words, the percentage of narrowing at the maximal stricture site on the RGU was found to be associated with the outcome of OIU. Out of the 37 patients who had undergone OIU in our study period, 11 patients who had a narrowing of less than 70% had a good outcome. In particular, all the 10 patients who had a narrowing in the range of 40 – 60% had good outcome with no recurrence till date. On the other hand, out of the remaining 27 patients who had a narrowing of more than 60 % on the RGU 26 patients had treatment failure and required repeat treatment at some point during the follow-up. Thus this method of using the percentage narrowing at the stricture site on a good RGU is a very useful method of judging the degree of spongiofibrosis at the stricture site which in turn can be used to predict the outcome of OIU. Factors which can influence the measurement are under-distension and over- distension of the distal urethra thus affecting the calculation of the percentage since the lumen of the distal urethra forms the denominator in our calculation. In order to ascertain correct filling of the distal urethra, a few hints may be taken into consideration. If the there is entry of contrast into posterior urethra, it suggests a correct filling the distal urethra. In the same way if there is intravasation of contrast, it denotes overfilling and such RGUs must be excluded and a fresh RGU may be ordered. Other factors like length of the stricture, site of the stricture and etiology of the strictures being equal, the degree of narrowing on the RGU may play a crucial role in the result of OIU. Thus it may be used in prognosticating or predicting the outcome of OIU. Studies have also indicated that a repeat OIU does not alter the overall results, thus a repeat OIU may not afterall be a good option in cases of OIU failures. Though there is nothing in the literature to say that multiple OIUs may influence the outcome of a future urethroplasty, it would be prudent to restrain from doing multiple OIUs in a particular patient as there is a chance of worsening the fibrosis and increasing the length of the stricture thereby precluding the possibility of a anastamotic urethroplasty and necessitating a substitution urethroplasty. Based on our present study, though the sample size is not great, there is a rough indication that those patients with a percentage narrowing of less than 60% on the RGU had a better outcome with OIU than those with a percentage narrowing of more than 60%. One of the limitations which we had encountered in our study was in the follow-up of the patients and the compliance of the patients to our instructions. Though we had given explicit instructions to the patient with regard to the follow-up timetable, many patients turned up late and a few did not turn up at all who were excluded from the study. In the same way, though the patients were properly instructed and demonstrated on the CIC technique, a few patients had not performed CIC. These issues may have to be addressed and taken into consideration when conducting any study of this nature and similarity. CONCLUSIONS Though OIU is a simple and safe procedure for bulbar urethral stricture patients it should not

be used indiscriminately. Improper selection of patients may necessitate multiple procedures on the same patient thus adversely affecting the quality of life and economic well-being of the patient. An easy way to assess the degree of spongiofibrosis without using a sonourethrogram is calculating the percentage narrowing at the maximal site of stricture on a RGU. This may be used to predict the outcome after OIU. In our study, patients with percentage narrowing of less than 60% on RGU had a better outcome than patients who had a percentage narrowing of more than 60%. Thus alternate treatment may be considered for such patients who have a high degree of narrowing on the RGU.